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Lira

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(54) **DISPLAY NAVIGATION**

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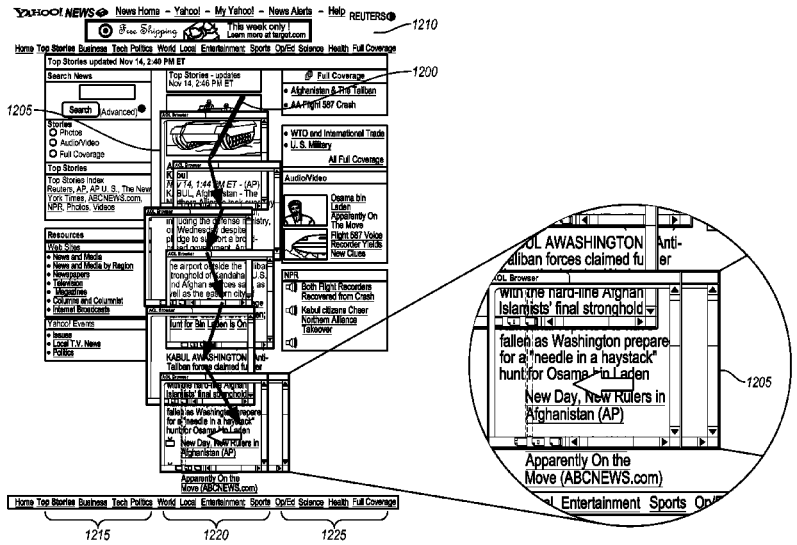
(57) **ABSTRACT**

Navigating on a display includes tracking motion of an input tool on a display, comparing a motion of the input tool to a threshold, and changing a position of the visible portion of a page of information on the display if the input tool motion exceeds the threshold. The position of the visible portion of the page of information on the display is constrained if the motion does not exceed the threshold.

30 Claims, 25 Drawing Sheets



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Excerpts From the Videorecorded Deposition of Ravin Balakrishnan, Ph.D., pp. 1, 6, 186, 265, in *Apple Inc.* v. *Samsung Electronics Co. Ltd.*, USDC N. District of California, Case: 11-cv-01846-LHK, dated Apr. 20, 2012.
Excerpts From the Videotaped Deposition of Ravin Balakrishnan, Ph.D., pp. 5, 151, 152, 153, 154, 155, 156, 157, 158, 337, in *Apple Inc.* v. *Samsung Electronics Co. Ltd.*, USDC N. District of California, Case: 11-cv-01846-LHK, dated Aug. 16, 2011.
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U.S. Appl. No. 13/731,364, Sep. 9, 2013, Office Action.
U.S. Appl. No. 13/731,364, Feb. 28, 2014, Office Action.
U.S. Appl. No. 13/731,364, Oct. 9, 2014, Office Action.
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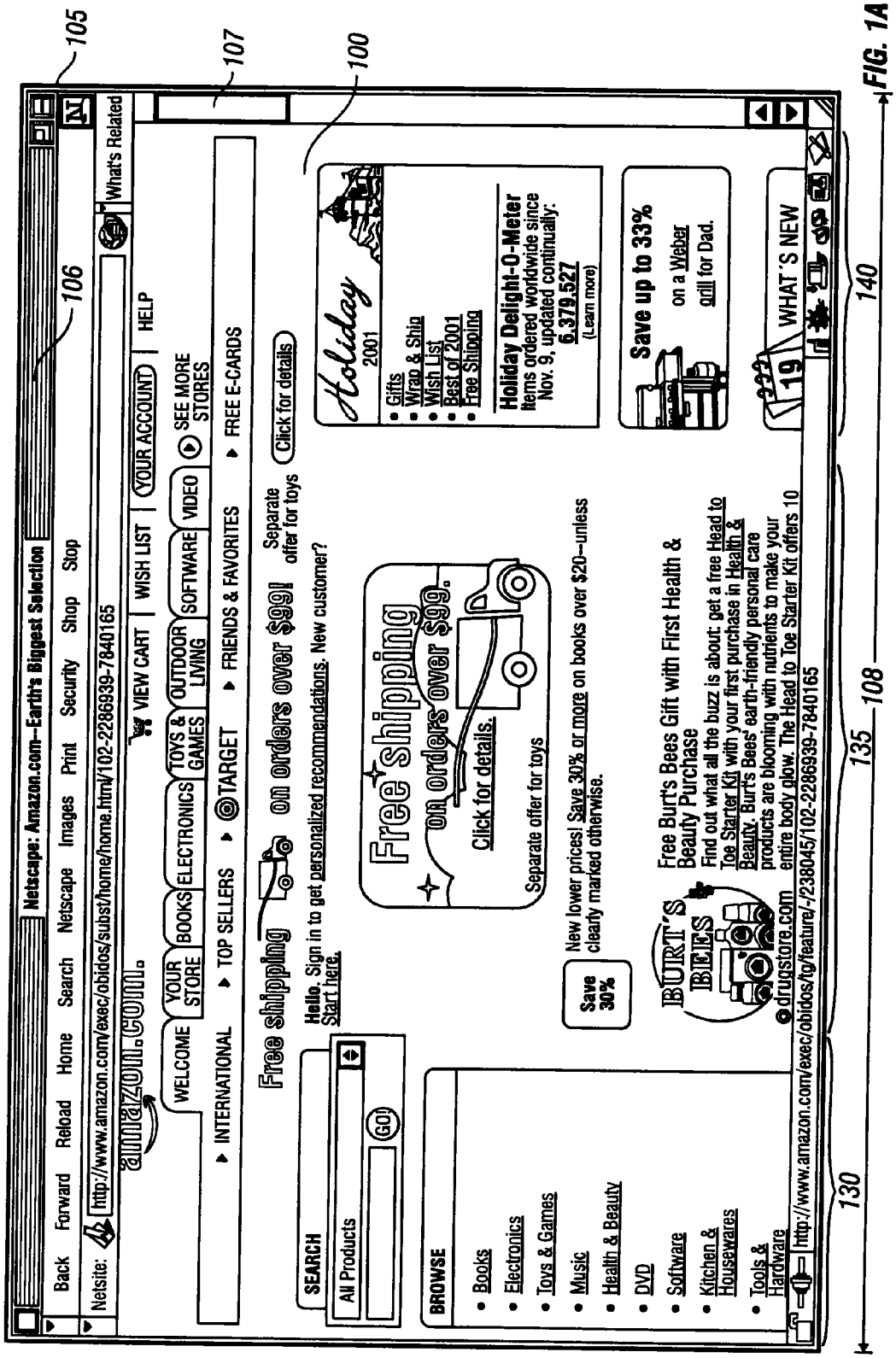
* cited by examiner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19
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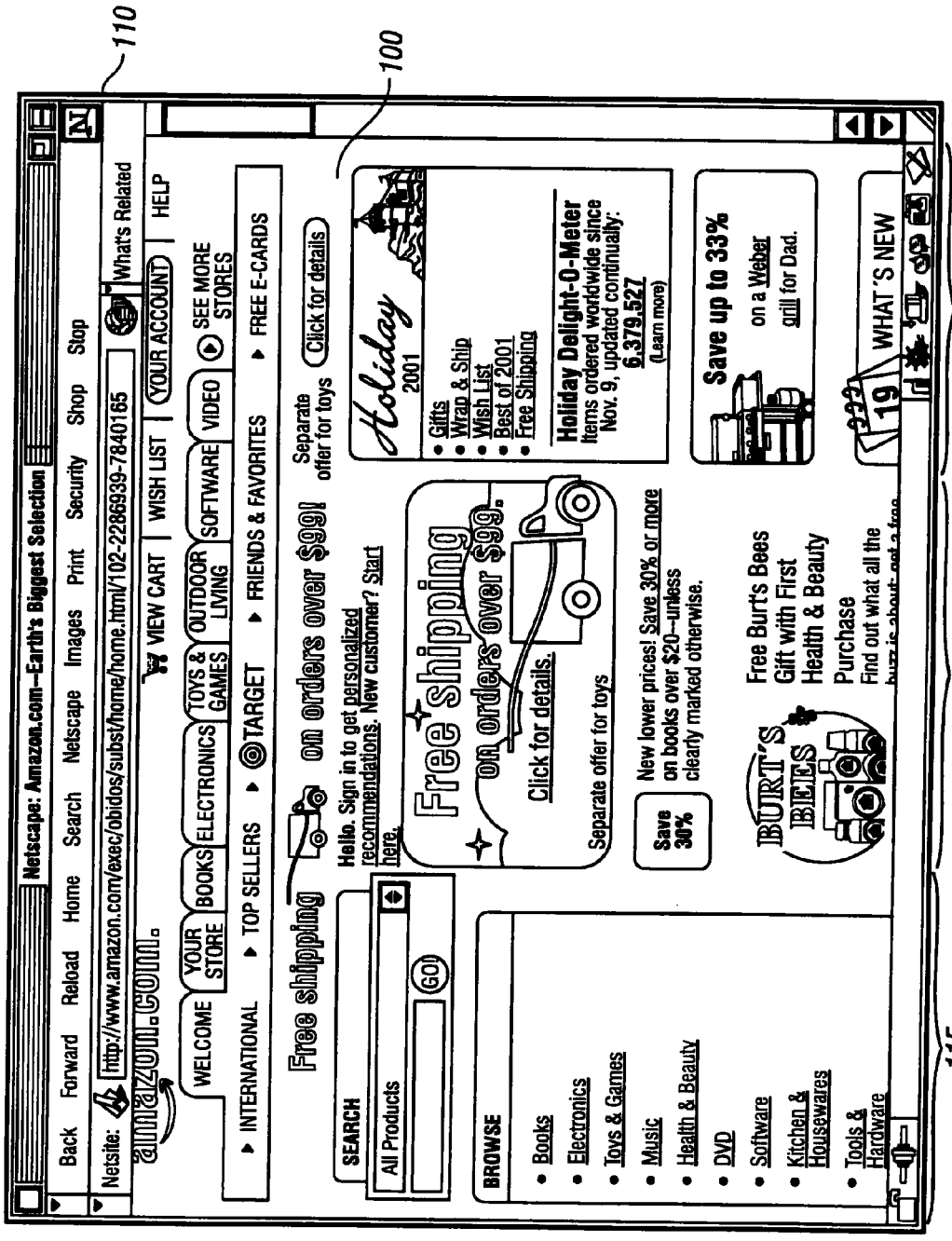
FIG. 1A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Save up to 33%
on a Weber grill for Dad.
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FIG. 1B

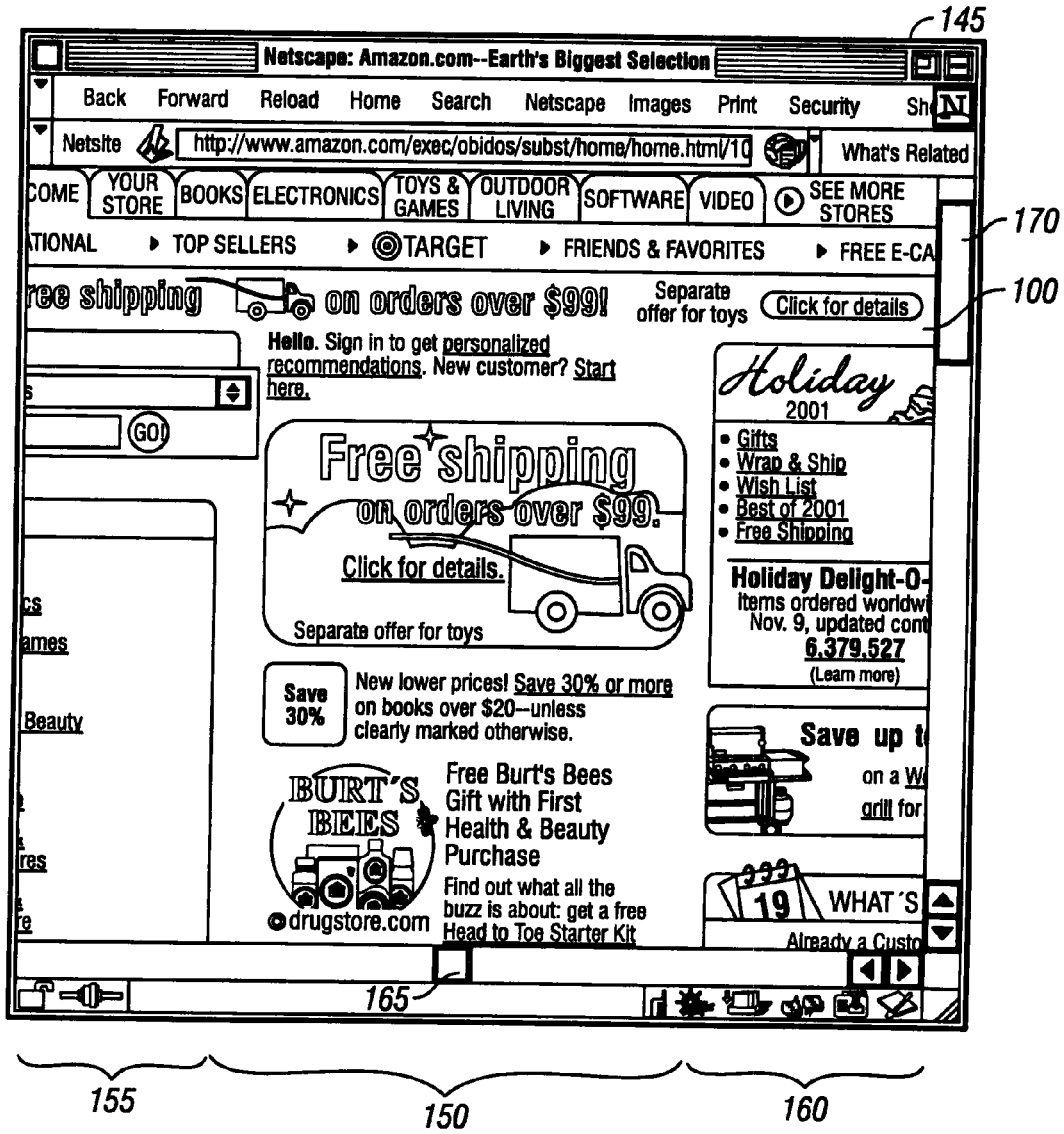
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FIG. 1C

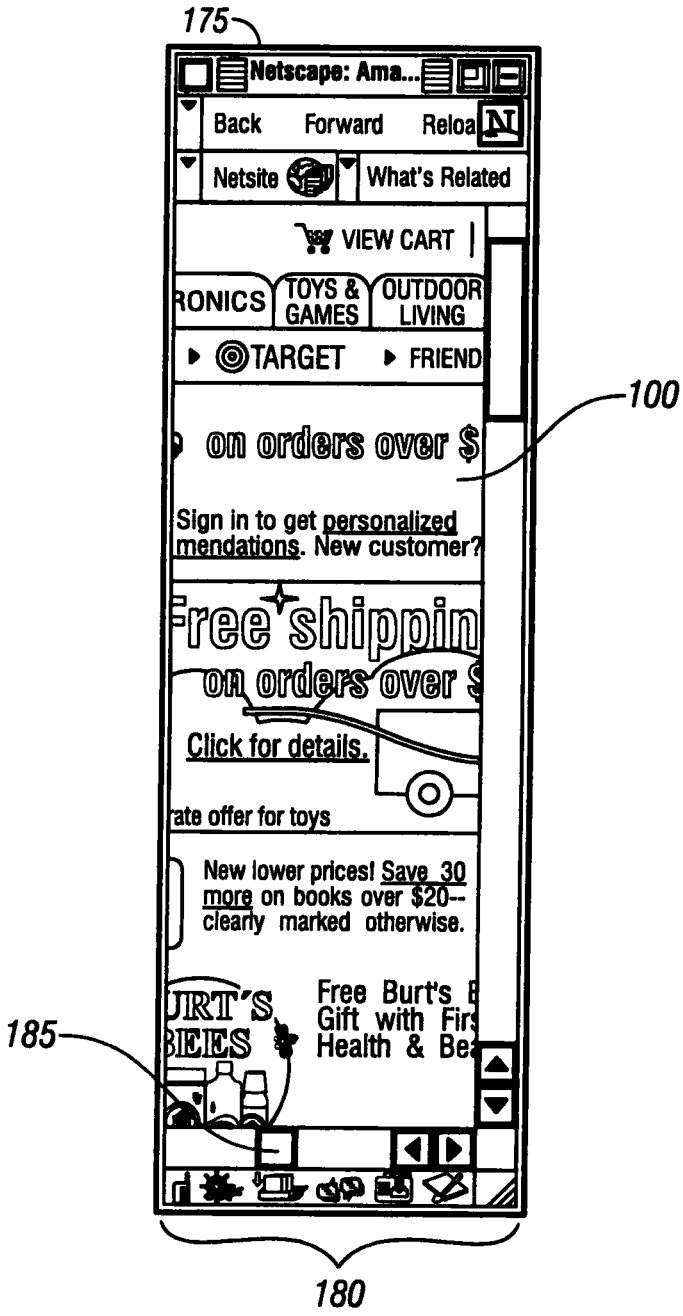
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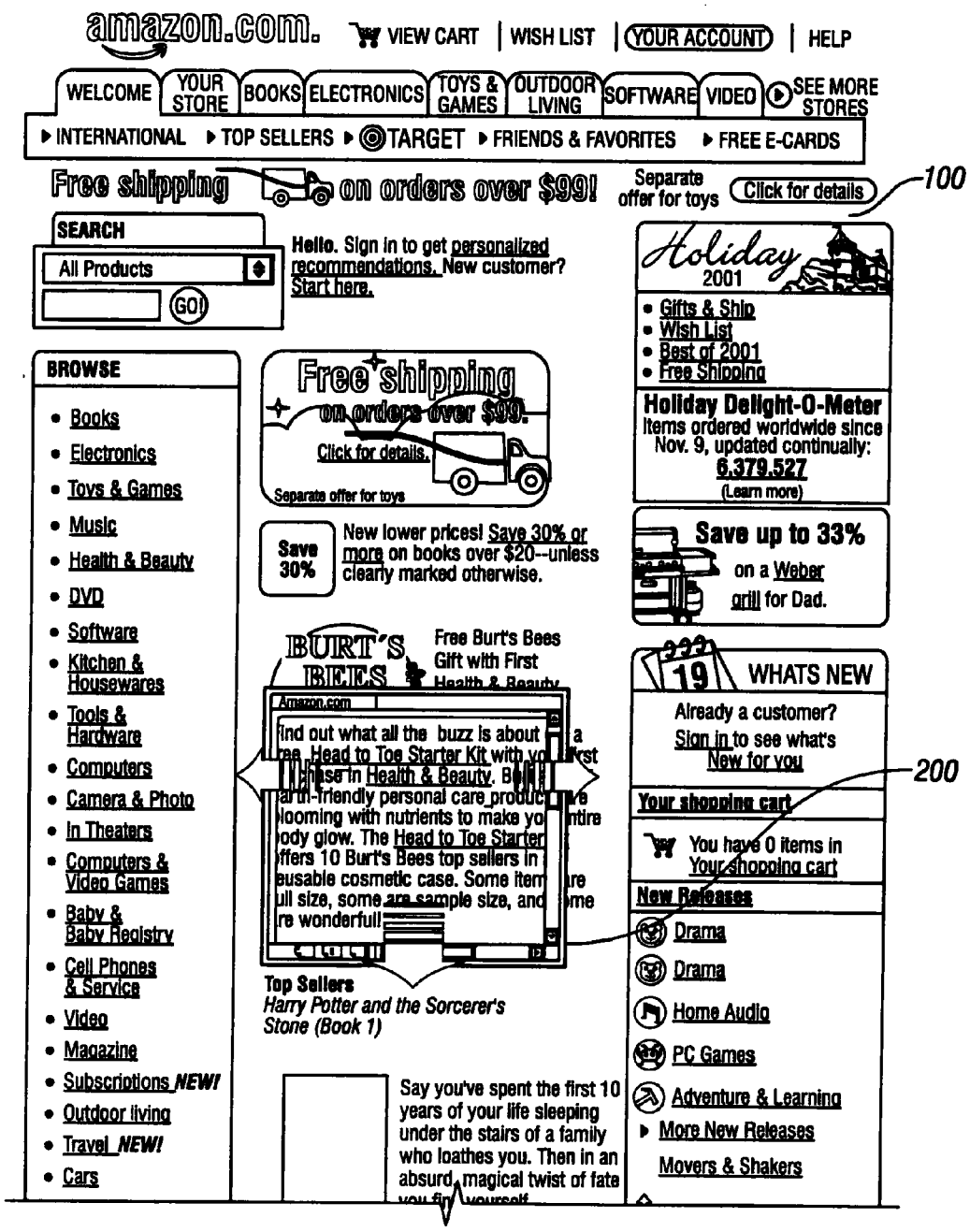
FIG. 1D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blooming with nutrients to make yo
body glow. The Head to Toe Starter
offers 10 Burt's Bees top sellers in
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full size, some are sample size, and
are wonderful!
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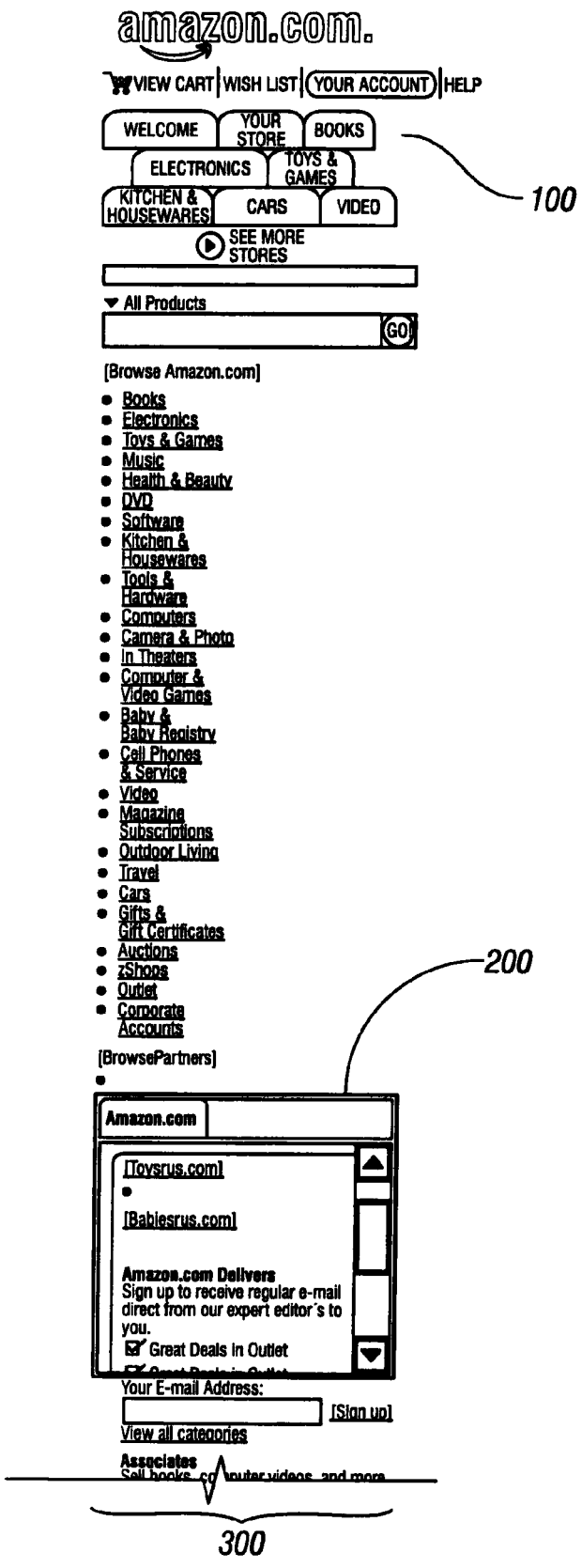
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[Sign up]
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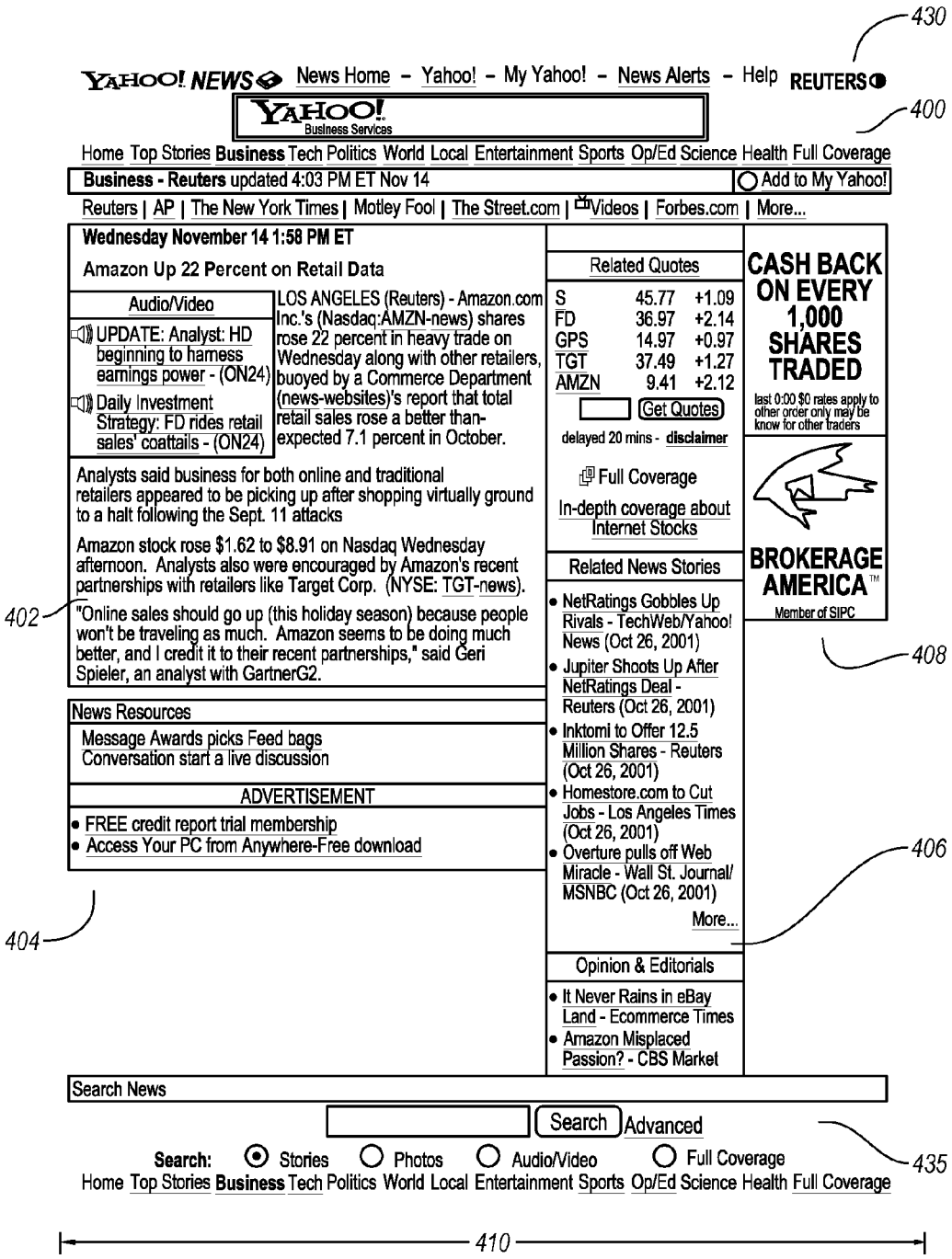
Associates
100
200
300

FIG. 3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Amazon Up 22 Percent on Retail Data
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UPDATE: Analyst: HD beginning to harness earnings power - (ON24)
Daily Investment Strategy: FD rides retail sales' coattails - (ON24)
LOS ANGELES (Reuters) - Amazon.com Inc.'s (Nasdaq:AMZN-news) shares rose 22 percent in heavy trade on Wednesday along with other retailers, buoyed by a Commerce Department (news-websites)'s report that total retail sales rose a better than-expected 7.1 percent in October.
Analysts said business for both online and traditional retailers appeared to be picking up after shopping virtually ground to a halt following the Sept. 11 attacks
Amazon stock rose $1.62 to $8.91 on Nasdaq Wednesday afternoon. Analysts also were encouraged by Amazon's recent partnerships with retailers like Target Corp. (NYSE: TGT-news).
"Online sales should go up (this holiday season) because people won't be traveling as much. Amazon seems to be doing much better, and I credit it to their recent partnerships," said Geri Spieler, an analyst with GartnerG2.
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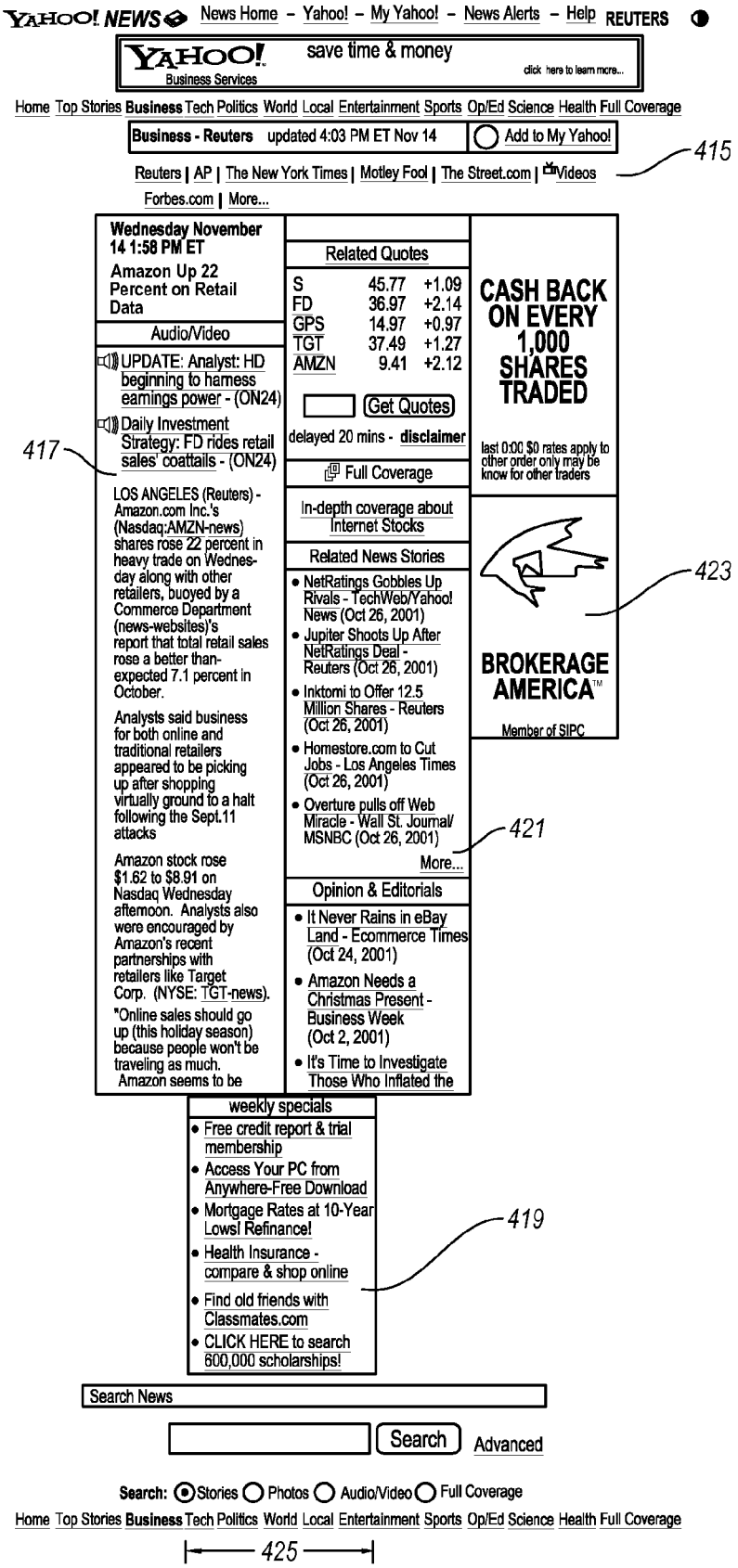
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It's Time to Investigate Those Who Inflated the
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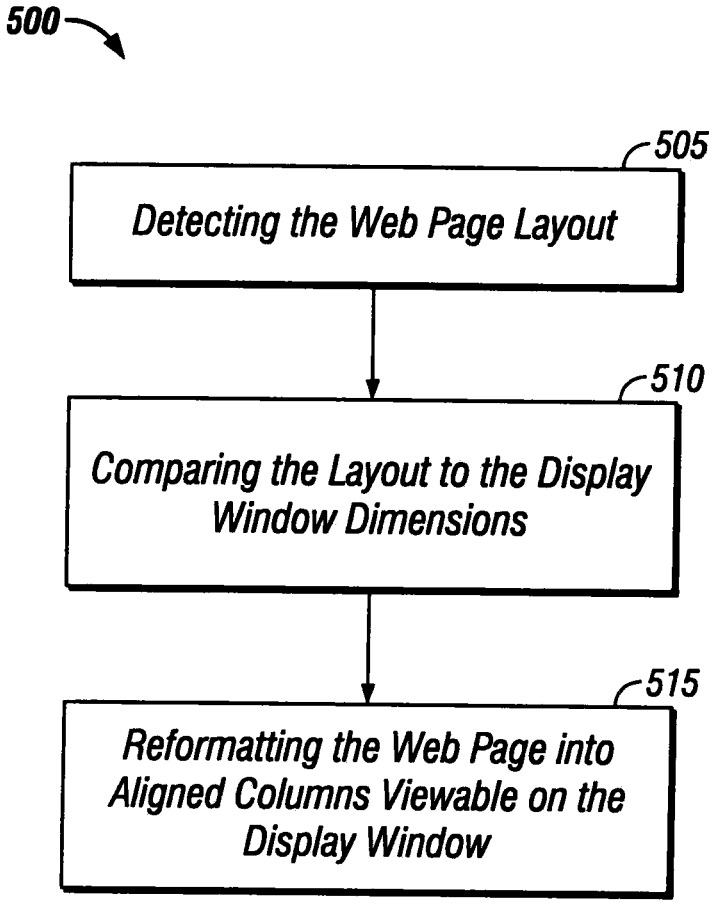
Fig. 4B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Detecting the Web Page Layout
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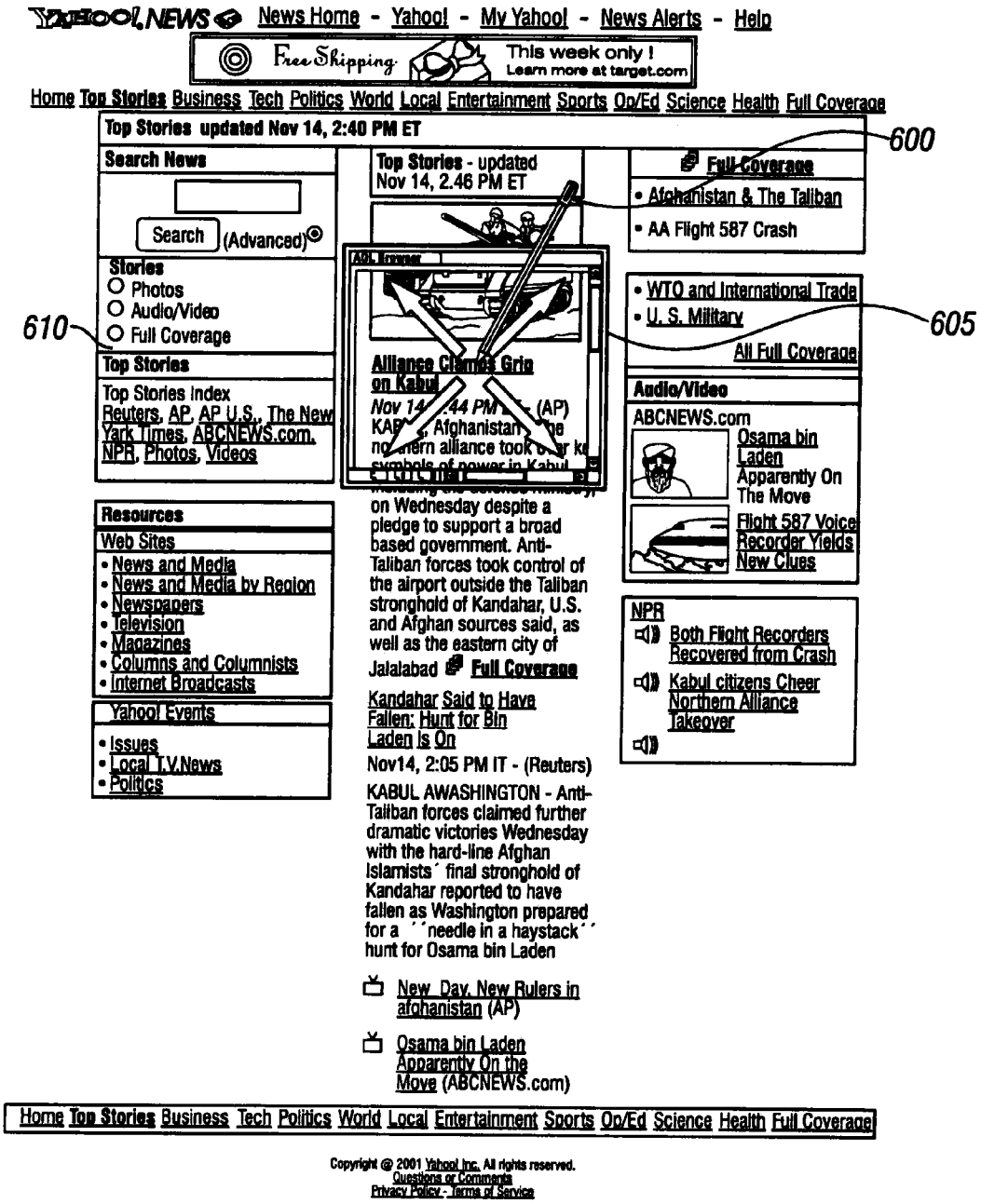
Comparing the Layout to the Display Window Dimensions
515
Reformatting the Web Page into Aligned Columns Viewable on the Display Window

FIG. 5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Alliance Claims Grip on Kabul
Nov 14, 2:44 PM ET (AP)
on Wednesday despite a pledge to support a broad based government. Anti-Taliban forces took control of the airport outside the Taliban stronghold of Kandahar, U.S. and Afghan sources said, as well as the eastern city of Jalalabad Full Coverage
Kandahar Said to Have Fallen; Hunt for Bin Laden Is On
Nov14, 2:05 PM IT - (Reuters)
KABUL AWASHINGTON - Anti-Taliban forces claimed further dramatic victories Wednesday with the hard-line Afghan Islamists´ final stronghold of Kandahar reported to have fallen as Washington prepared for a ´´needle in a haystack´´ hunt for Osama bin Laden
New Day, New Rulers in afghanistan (AP)
Osama bin Laden Apparently On the Move (ABCNEWS.com)
Full Coverage
• Afghanistan & The Taliban
• AA Flight 587 Crash
• WTO and International Trade
• U. S. Military
605
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Osama bin Laden Apparently On The Move
Flight 587 Voice Recorder Yields New Clues
NPR
Both Flight Recorders Recovered from Crash
Kabul citizens Cheer Northern Alliance Takeover
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FIG. 6

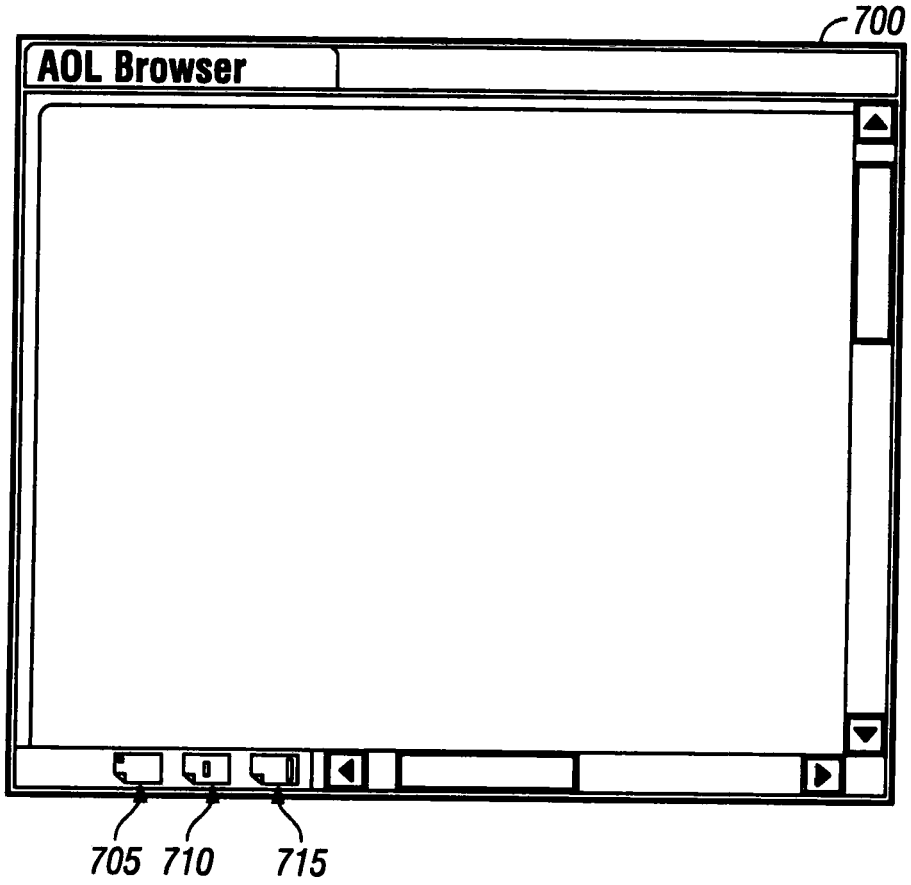
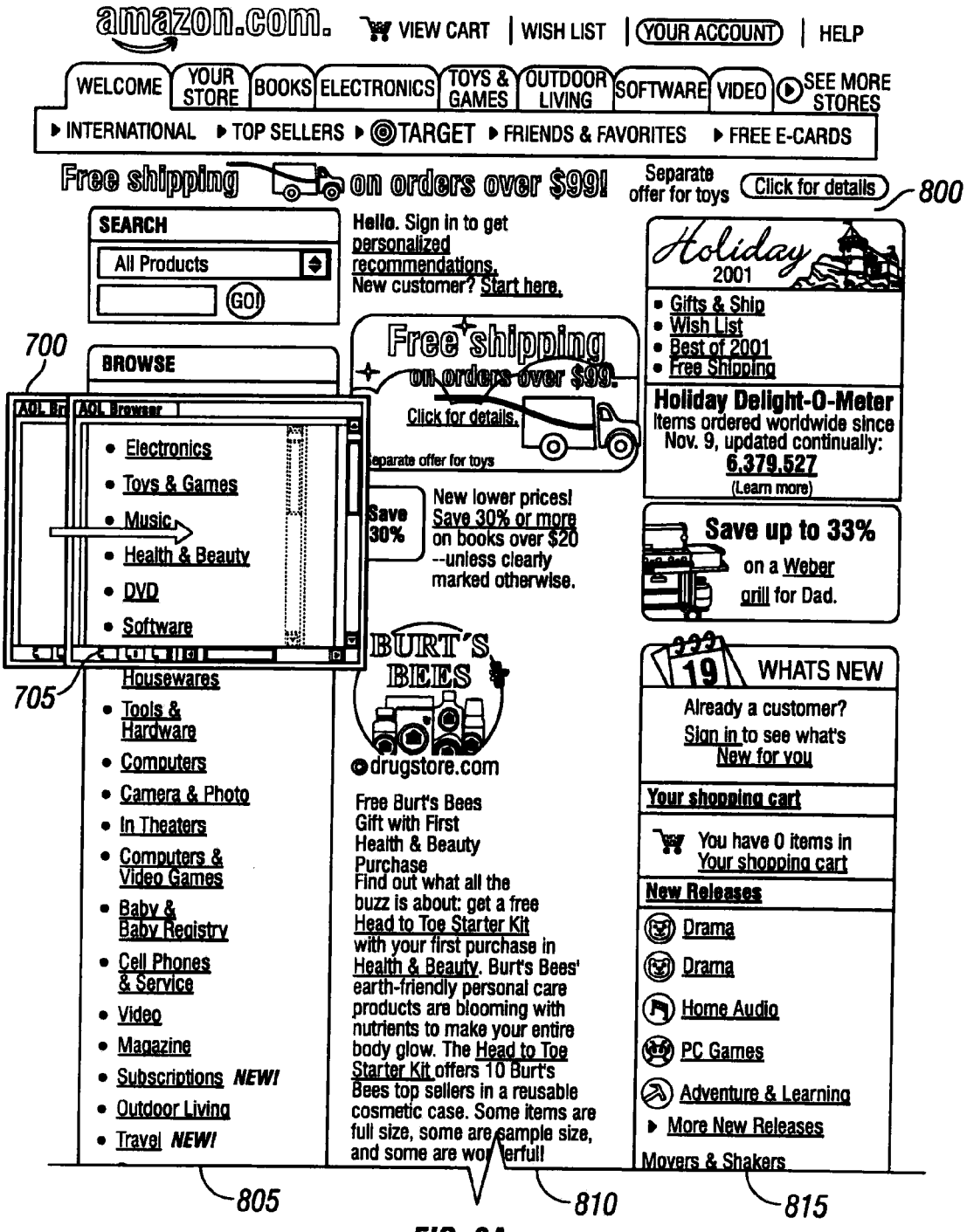


FIG. 7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Find out what all the buzz is about: get a free Head to Toe Starter Kit with your first purchase in Health & Beauty. Burt's Bees' earth-friendly personal care products are blooming with nutrients to make your entire body glow. The Head to Toe Starter Kit offers 10 Burt's Bees top sellers in a reusable cosmetic case. Some items are full size, some are sample size, and some are wonderful!
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FIG. 8A

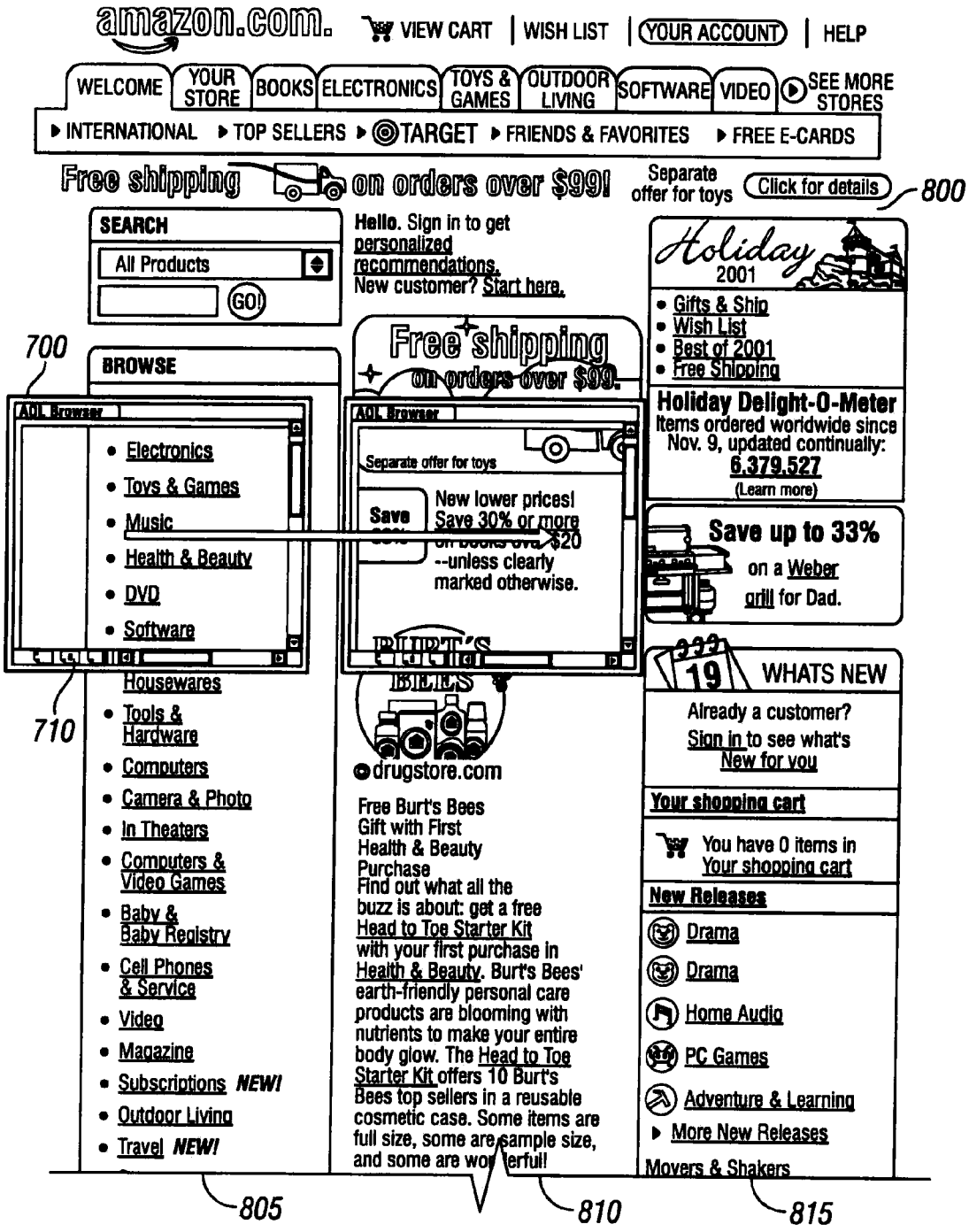
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FIG. 8B

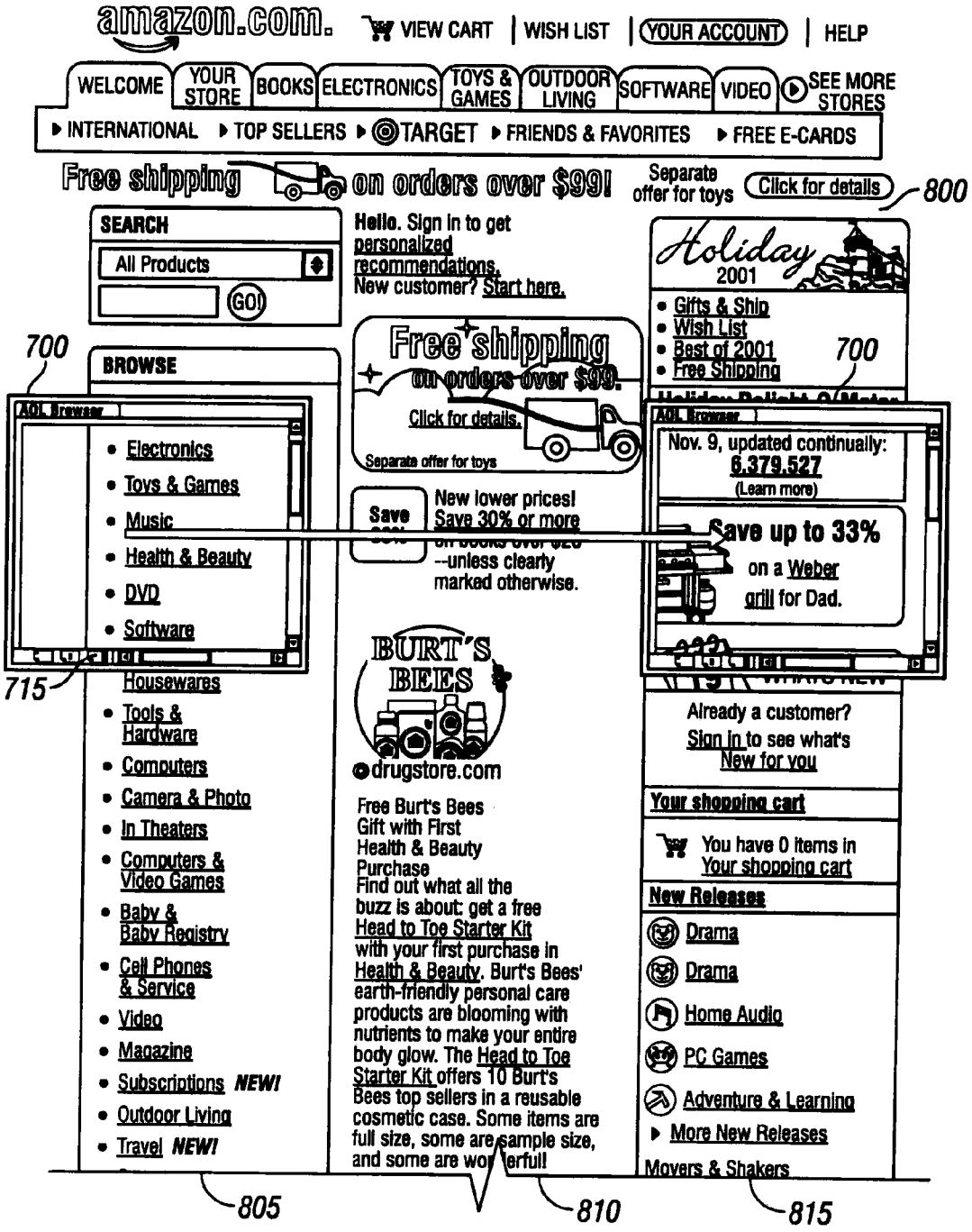
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FIG. 8C

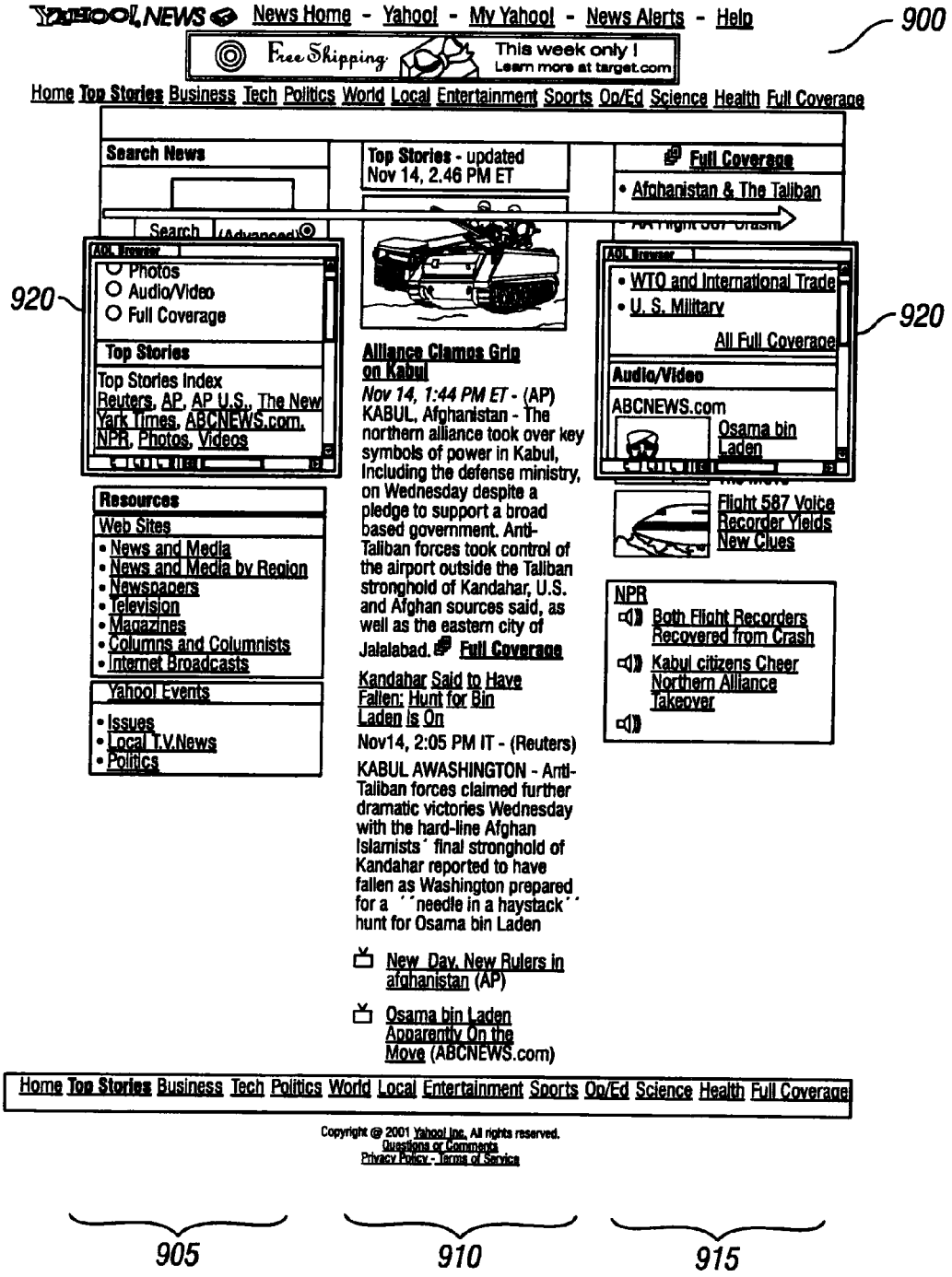
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FIG. 9

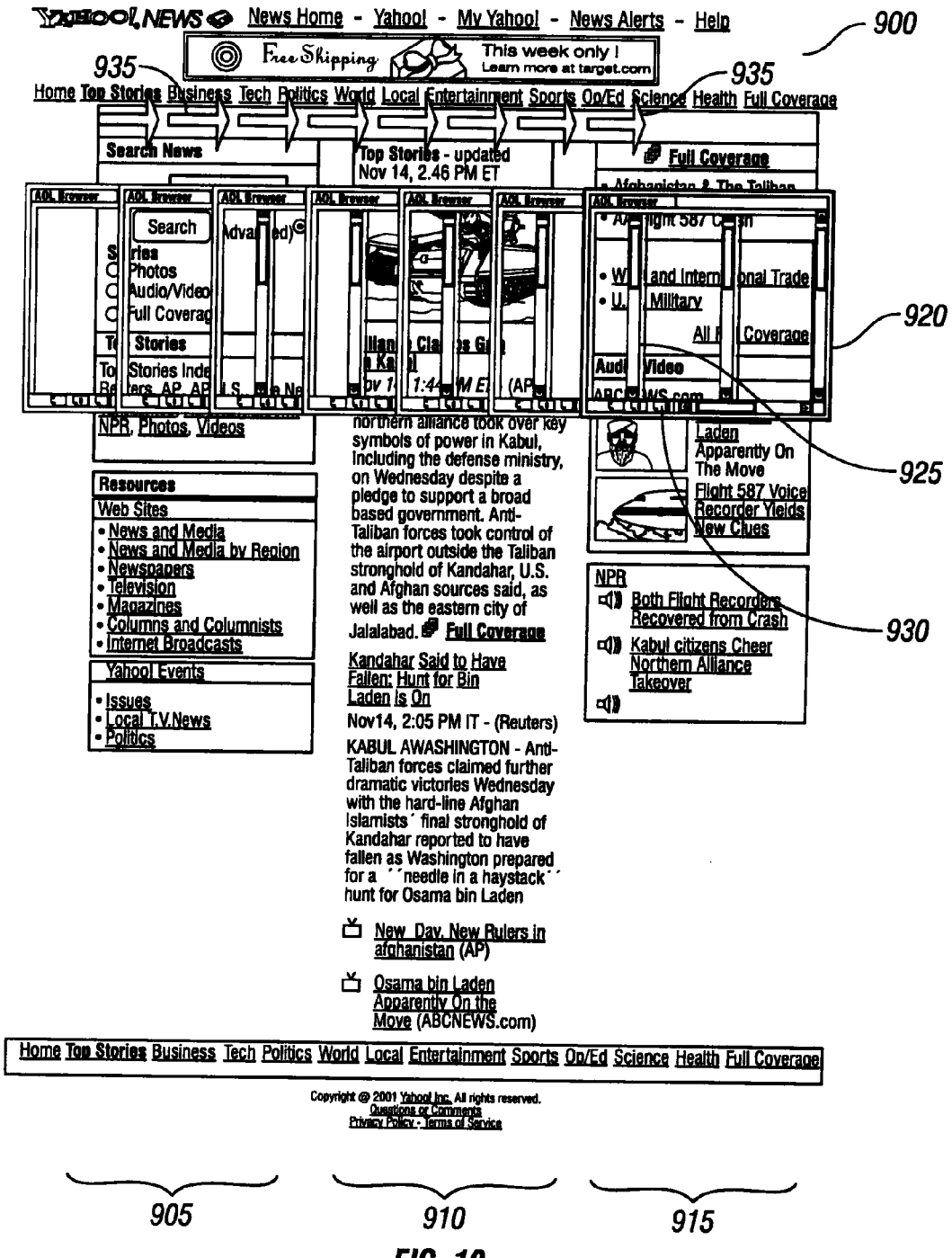
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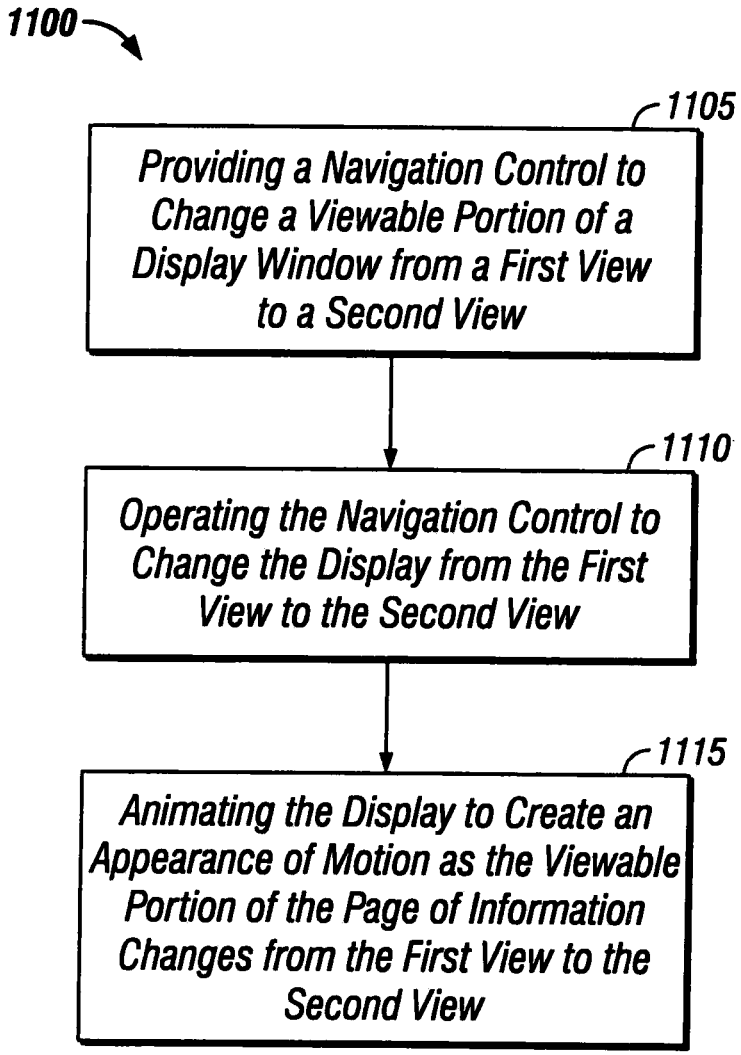
FIG. 10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Providing a Navigation Control to Change a Viewable Portion of a Display Window from a First View to a Second View
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Operating the Navigation Control to Change the Display from the First View to the Second View
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Animating the Display to Create an Appearance of Motion as the Viewable Portion of the Page of Information Changes from the First View to the Second View

FIG. 11

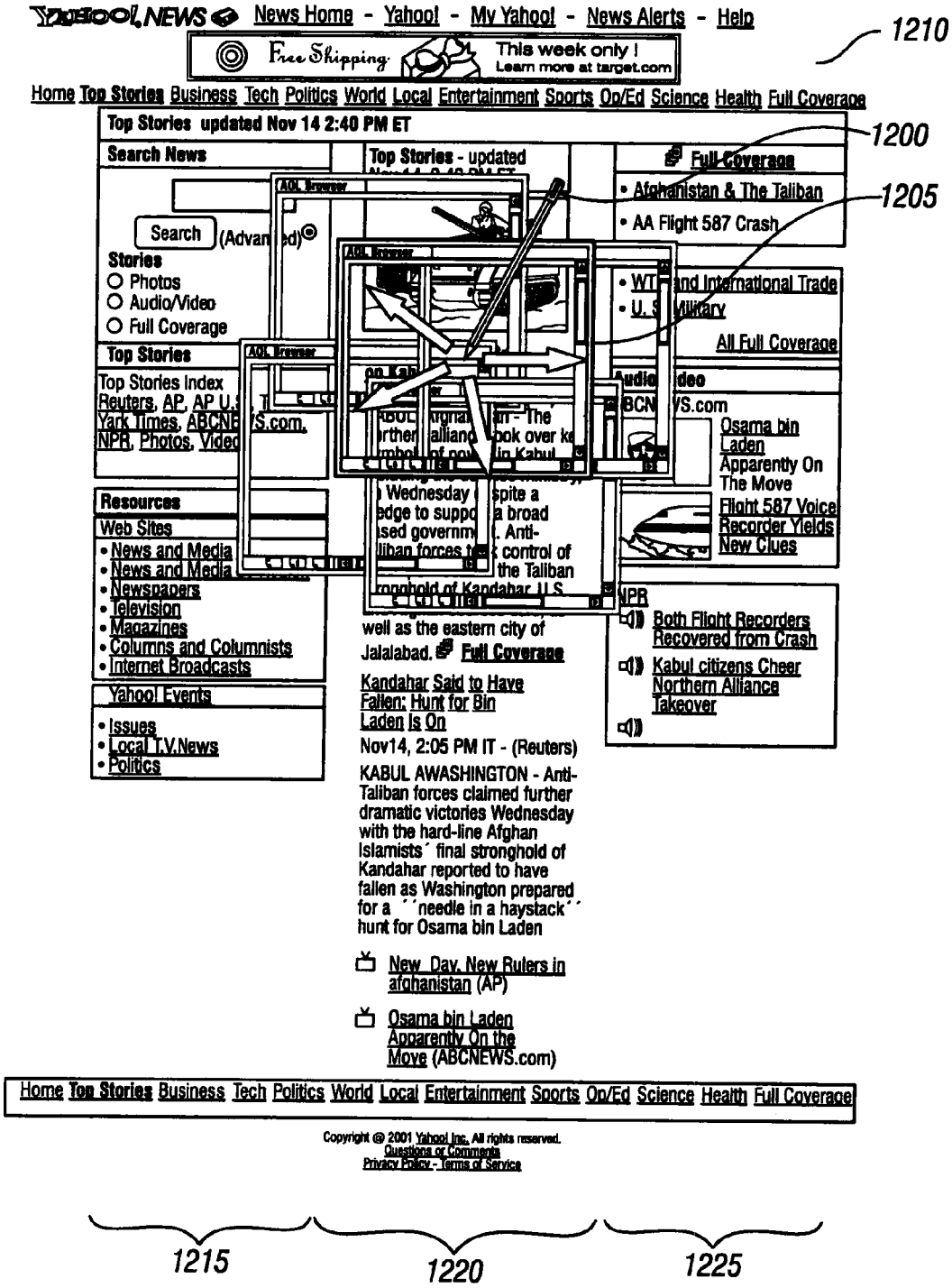
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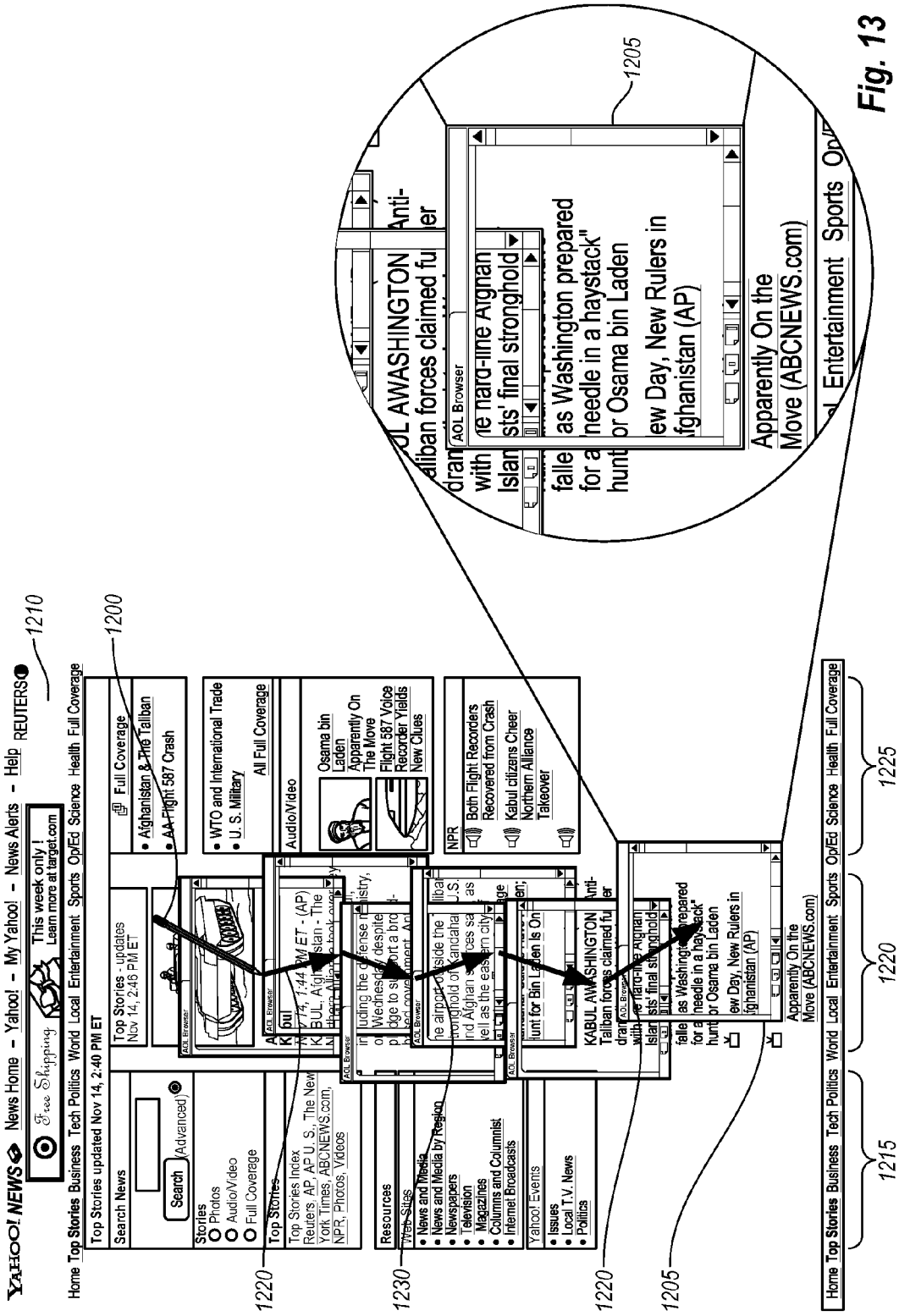
FIG. 12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KABUL AWASHINGTON
Taliban forces claimed fu
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Fig. 13

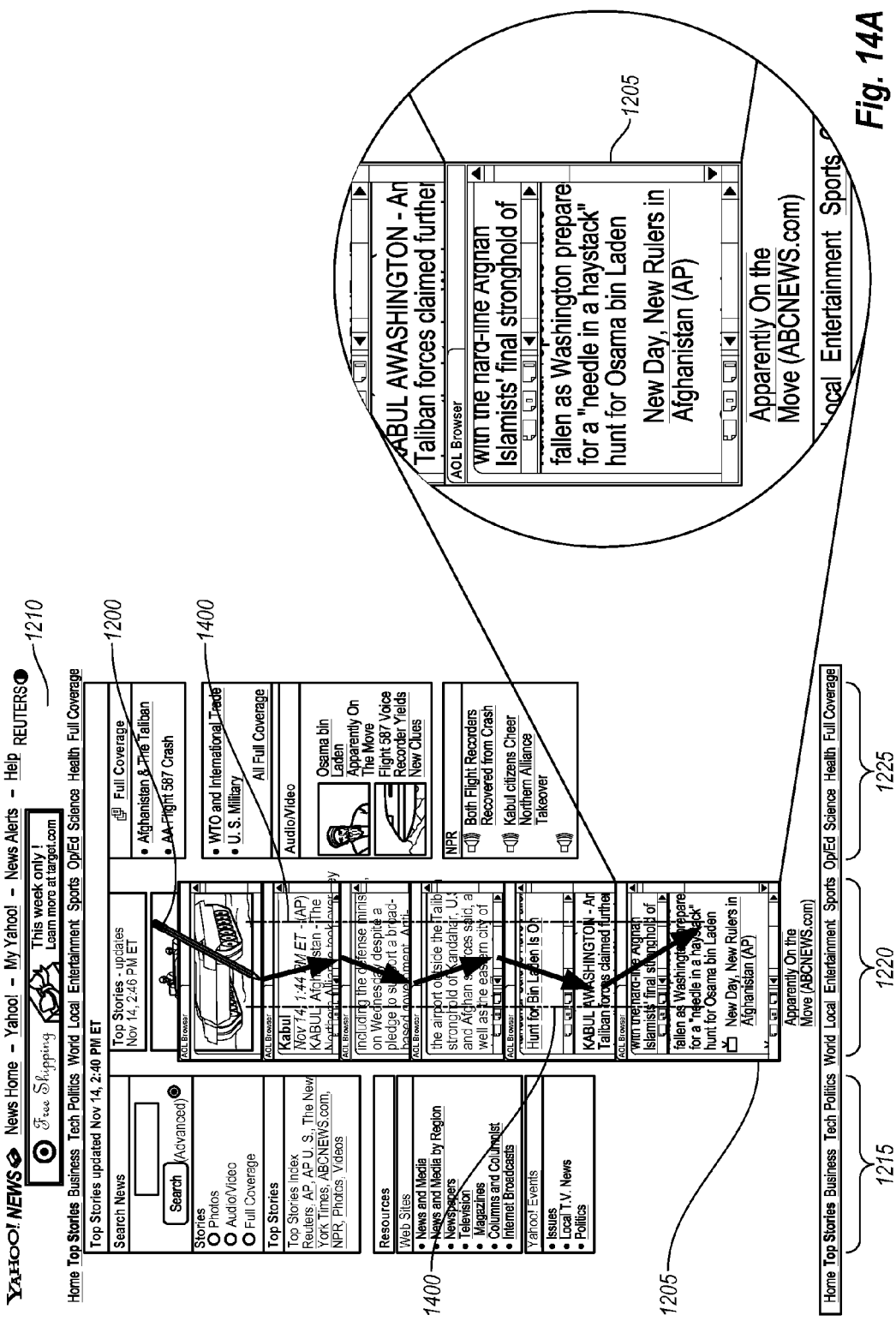
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Fig. 14A

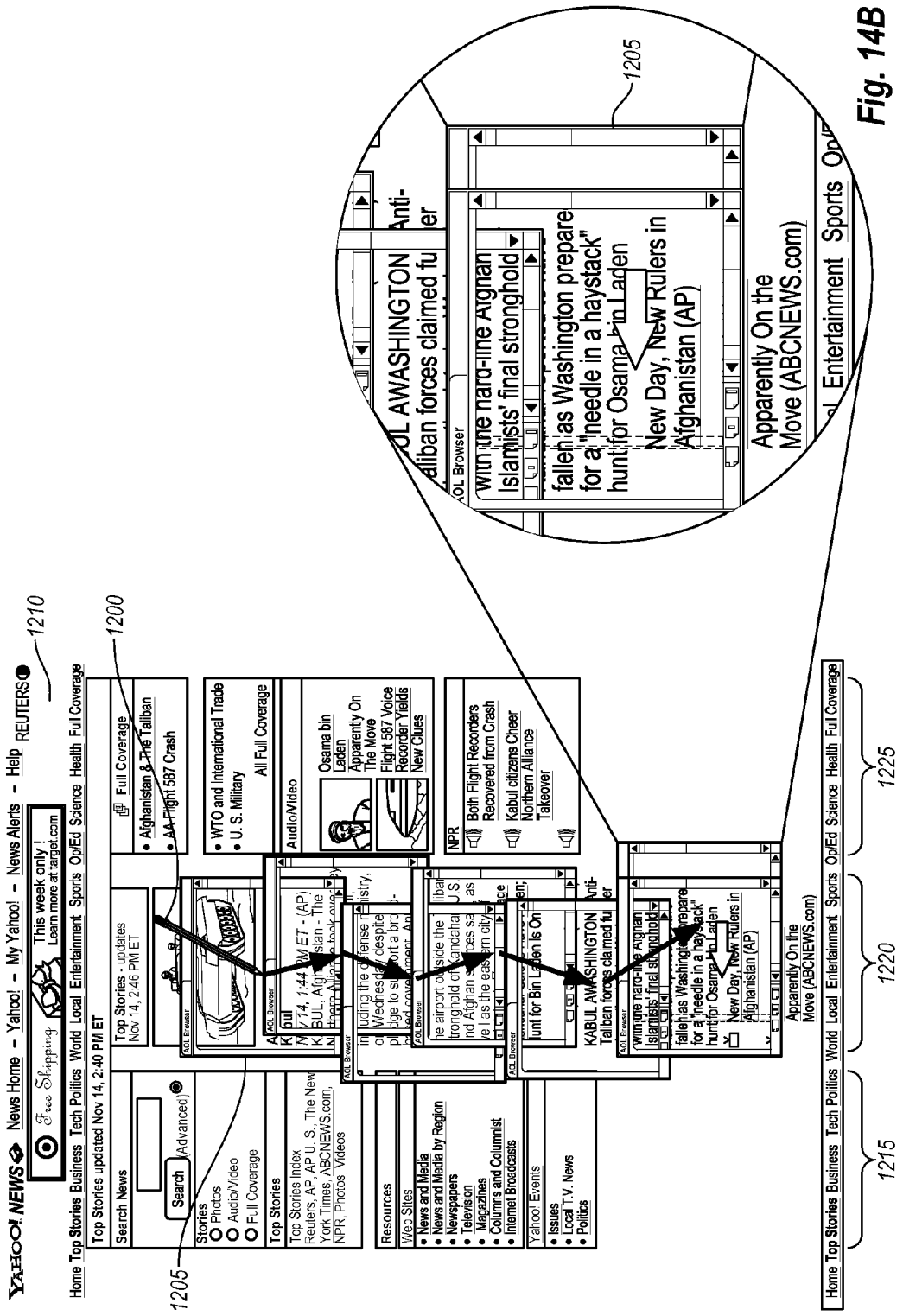
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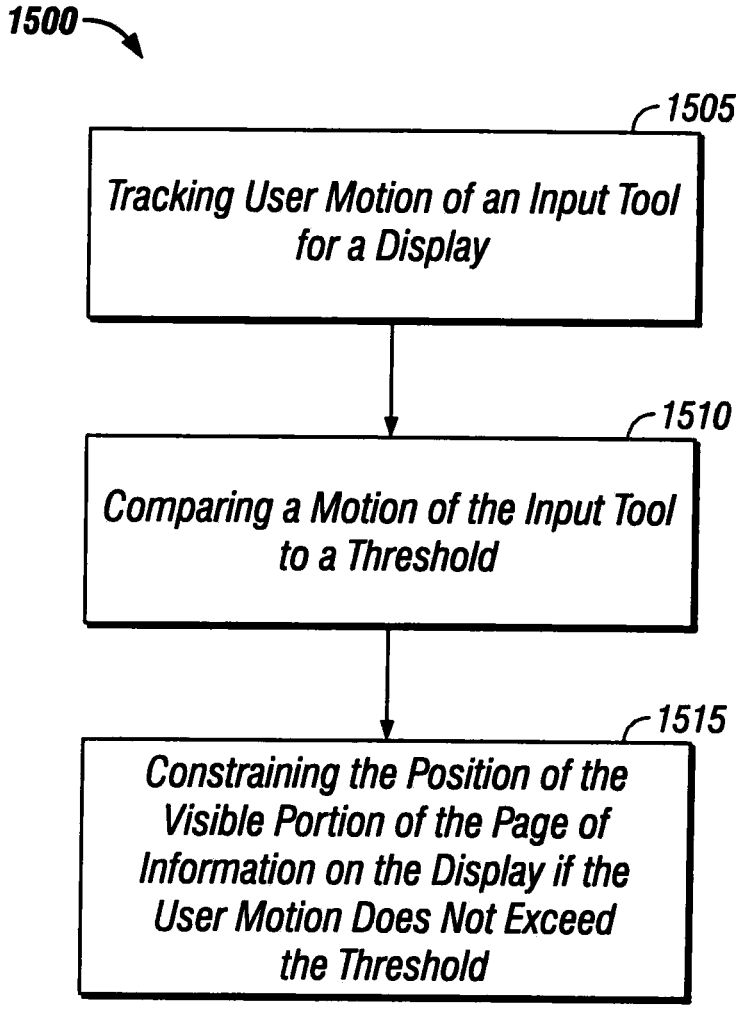
Fig. 14B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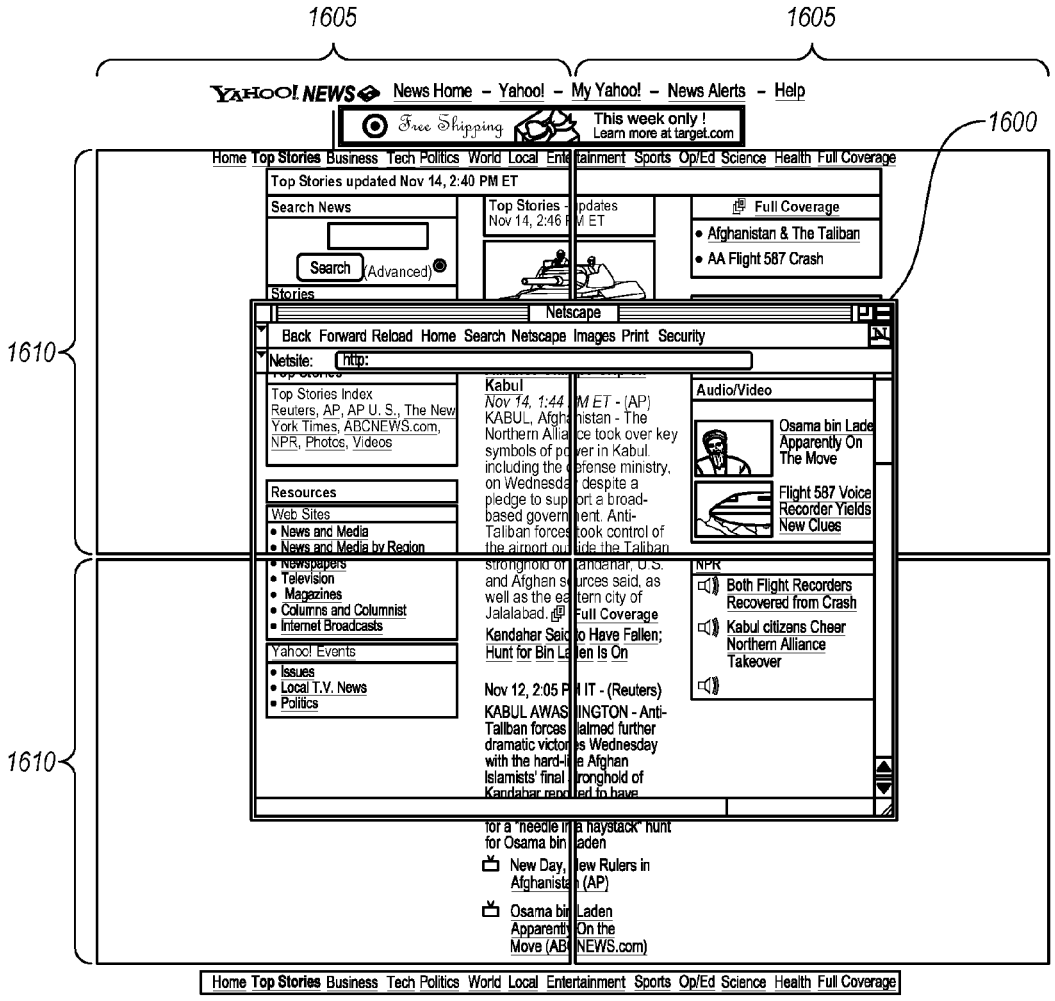
Tracking User Motion of an Input Tool for a Display
1510
Comparing a Motion of the Input Tool to a Threshold
1515
Constraining the Position of the Visible Portion of the Page of Information on the Display if the User Motion Does Not Exceed the Threshold

FIG. 15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Nov 12, 2:05 PM IT - (Reuters)
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Fig. 16

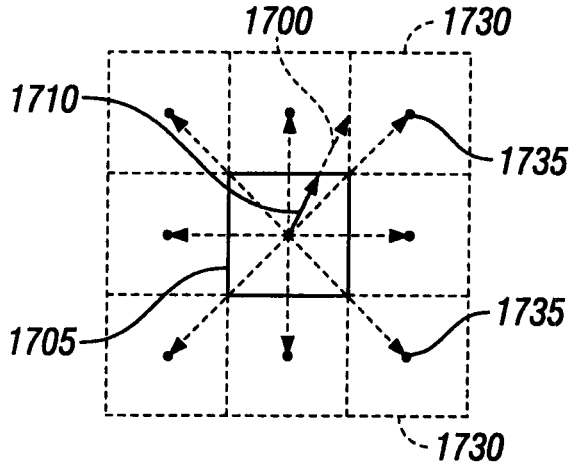

FIG. 17A

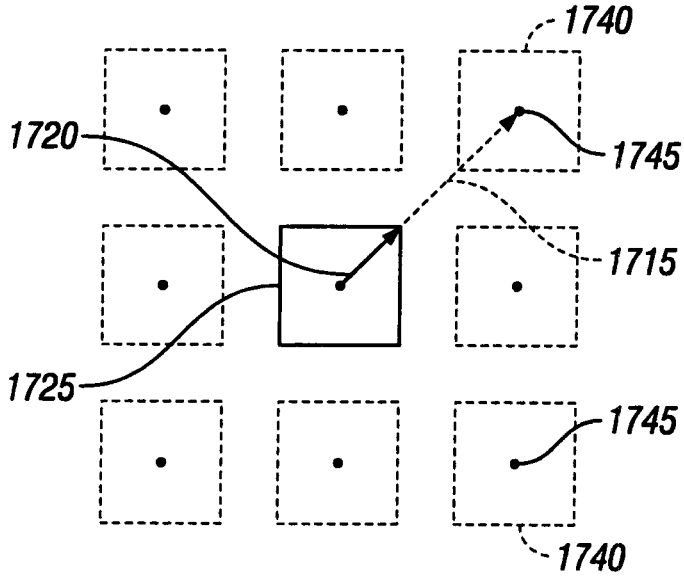

FIG. 17B

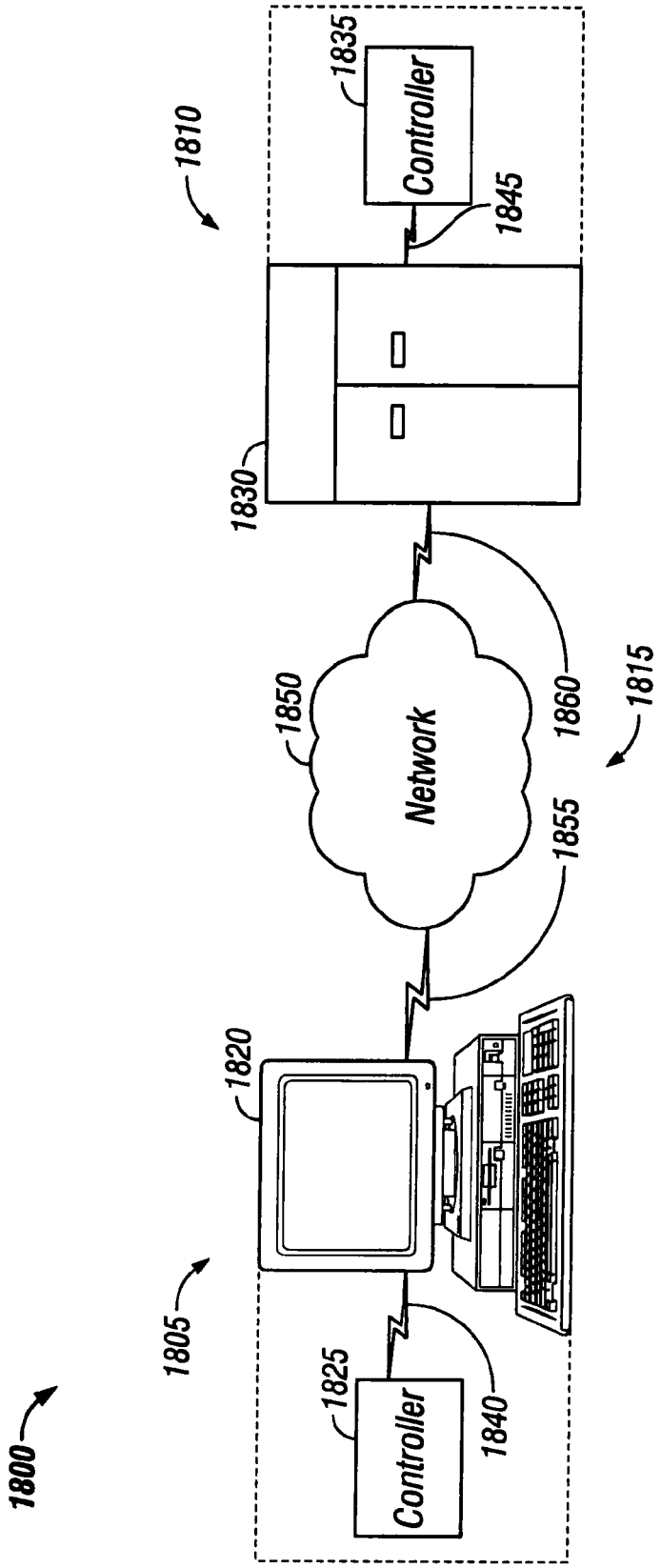
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FIG. 18

DISPLAY NAVIGATION

CROSS REFERENCE TO RELATED APPLICATIONS

This application is a continuation of U.S. application Ser. No. 13/683,828, filed on Nov. 21, 2012, which is a continuation of U.S. application Ser. No. 12/963,444 filed on Dec. 8, 2010, which is a continuation of U.S. application Ser. No. 11/617,997 filed on Dec. 29, 2006 and issued as U.S. Pat. No. 7,872,640, which is a continuation of U.S. application Ser. No. 10/307,403 filed on Dec. 2, 2002, now U.S. Pat. No. 7,193,609, which claims the benefit of U.S. Provisional Application Nos. 60/368,988 filed on Apr. 2, 2002; 60/365,160 filed on Mar. 19, 2002; 60/365,161 filed on Mar. 19, 2002; and 60/365,197 filed on Mar. 19, 2002. Each of the aforementioned applications and patents are hereby incorporated by reference in their entirety.

TECHNICAL FIELD

The following description relates generally to a viewing and navigation aid for displaying information on an electronic device having limited display capability.

BACKGROUND

Web pages and other electronic documents generally are formatted for viewing and navigation in display windows of standard-sized or oversized displays, such as, for example, in a display window on a monitor for a desktop computer. The user of the computer can view the entire Web page on one screen display or can easily scroll a short distance to view other portions of the Web page. However, when content is displayed on an electronic device having a display window with smaller dimensions, such as, for example, the display window of a personal digital assistant ("PDA") only a small portion of the Web page is displayed. This may render the document may be difficult to read.

SUMMARY

In one general aspect, navigating on a display includes tracking motion of an input tool on a display, comparing the motion of the input tool to a threshold, changing the position of the visible portion of a page of information on the display if the motion exceeds the threshold, and constraining the position of the visible portion of the page of information on the display if the motion does not exceed the threshold.

Implementations may include one or more of the following features. For example, the input tool may be a pen stylus or a finger, and tracking motion of the input tool may include tracking the pen or finger on the display surface.

The display may include a touch screen and tracking motion of the input tool may include tracking motion of the input tool on the touch screen. The touch screen may include, for example, a resistive sensor, a capacitive sensor, an acoustic wave sensor, or an infrared sensor. The touch screen may include a sensor activated by a touch activation force by the input tool on the display.

The motion may be separated into a horizontal component and a vertical component relative to the display, the horizontal component may be compared to the threshold, and horizontal movement of the visible portion of the page of information on the display may be constrained if the horizontal component does not exceed the threshold. Vertical motion may be left uncompared and unconstrained or comparing the motion also may include comparing the vertical component and constraining the vertical movement of the visible portion of the page of information on the display. Comparing the motion of the input tool to the threshold may include comparing the motion of the input tool to a user-defined threshold or to a system-defined threshold.

The page of information may include columns of information, and constraining the position of the page of information on the display may include constraining the position of the columns of information on the display or constraining the horizontal position of a column of information on the display. The columns of information may include logical columns, and constraining may include constraining the horizontal position of a logical column on the display.

In another general aspect, navigating on a display includes moving a stylus on a display to cause the display to change the viewable portion of the page of information on the display from a first page view to a second page view, tracking the motion of the stylus on the display, comparing a horizontal motion of the stylus on the display to a threshold, maintaining the viewable portion of the page of information at the first page view if the horizontal motion does not exceed the threshold, and positioning the viewable portion of the page of information at the second page view if the horizontal motion exceeds the threshold.

Implementations may include one or more of the features described above.

In another general aspect, navigating on a display includes tracking a motion of a stylus in contact with a display surface of a device that is operable to change a position of a visible portion of a page of information on the display from a first page position to a second page position in response to the motion of the stylus. A horizontal or vertical component of the motion of the stylus on the display surface is compared to a threshold, and the visible portion of the page of information on the display is repositioned to a horizontal or vertical position corresponding to the first page position after the pen stylus is removed from the display surface if the horizontal or vertical component does not exceed the threshold.

Implementations may include one or more of the features described above.

Implementations of the techniques described may include a method or process, an apparatus or system, or computer software on a computer-accessible medium. The techniques may be used in conjunction with devices such as, for example, PDAs, telephones, including wireless and web phones, handheld computers, monitors, games, and electronic books. The details of one or more implementations are set forth in the accompanying drawings and the description below. Other features will be apparent from the description, the drawings, and the claims.

DESCRIPTION OF DRAWINGS

FIGS. **1**A-**1**D are screen shots of a page on display windows of varying dimensions.

FIG. **2** illustrates a display window superimposed onto a page.

FIG. **3** illustrates a display window superimposed onto a column of information from a page.

FIGS. **4**A and **4**B illustrate reformatting of a page.

FIG. **5** is a flow chart of a method of reformatting a page.

FIG. **6** illustrates a display window and pen stylus superimposed onto a page.

FIG. **7** illustrates a display window with navigation buttons.

FIGS. **8**A-**8**C illustrate display windows superimposed onto a page.

FIGS. **9** and **10** each illustrate a display window superimposed onto a page.

FIG. **11** is a flow chart of a method of navigating on a display window.

FIGS. **12**, **13**, **14**A and **14**B each illustrate a display window superimposed onto a page.

FIG. **15** is a flow chart of a method of constraining the scrolling of information on a display window.

FIG. **16** illustrates a display window superimposed onto a page.

FIGS. **17**A and **17**B each illustrate a display window and a stylus.

FIG. **18** is a block diagram of a computer and communications system.

Like reference symbols in the various drawings indicate like elements.

DETAILED DESCRIPTION

Pages coded according to hypertext markup language ("HTML") are designed for display in display windows of different sizes. On smaller displays, a width of a display window often corresponds to a width of a display minus a width of a window frame and a width of a vertical scroll bar, and may be constrained to be no larger. On larger displays, the width of a display window may constitute a smaller portion of the entire width of the display. In some cases, a display window may constitute the entirety of the display (i.e., there may be no window frame or scroll bar). In other cases, the display window may be purposefully sized to be substantially smaller than the overall size of the display. For example, a user of a desktop system with a large display may open a small display window to view a particular page.

Typically, a page expands or shrinks to match the width of the display window. FIG. **1**A illustrates a page **100** in a wide display window **105** having a window frame **106** and a scroll bar **107**. The display window **105** may be, for example, the window that would be displayed on the monitor of a desktop computer. As shown, the page **100** expands to fit the window width **108**.

FIG. **1**B shows the page **100** on a device having a smaller display window **110**. As shown, the page width is reduced to fit the width of the display window **110** by reducing the width of columns **115**, **120** and **125** presented in the display window **100** relative to the width of corresponding columns **130**, **135** and **140** in the display window **105**. In particular, the center column **120** in the display window **110** is substantially narrower than the corresponding center column **135** in the display window **105**.

The width of the columns may only be reduced until a minimum width for the page is reached. FIG. **1**C shows the page **100** in a display window **145** that is narrower than the established minimum width of the page **100** such that the page **100** exceeds the bounds of the display window **145** and only a portion of the page **100** is displayed by display window **145**. As shown, the entire width of the center column **150** is displayed, while only portions of the left column **155** and the right column **160** are displayed. The display window **145** also includes a horizontal scroll bar **165** and a vertical scroll bar **170** for use in selecting and viewing the columns and the portions thereof that are displayed.

In some cases, the display window is narrower than the width of a single column. For example, FIG. **1**D shows the page **100** in a display window **175** of a portable electronic device, such as, for example, an Internet-enabled cellular telephone. As shown, only a portion of a single column **180** is displayed. As a result, the user must scroll back and forth horizontally, using, for example, a scroll bar **185**, to read each line of text.

FIG. **2** illustrates a display window **200** superimposed onto the page **100**. The display window **200** is representative of the display of, for example, a PDA. Since the page and column are each larger than the display window **200**, the user must scroll back and forth to read each line of text. PDA browsers may use various reformatting methods to enhance the readability of the page. Reformatting may include scaling down images, text size, and other page components.

FIG. **3** shows the page **100** reformatted as a single column **300**. In particular, the columns of the page **100** are stacked to form the single column **300**, the width of the column **300** is limited to the width of the display window **200**, and word wrapping is used to provide continuity/readability. The display window **200** stays centered on the column as the user scrolls down the page to read the text.

FIGS. **4**A and **4**B show that a page **400** (FIG. **4**A) having elements **402**, **404**, **406** and **408** of differing widths and sized to fit a wide window width **410** may be reformatted as a page **415** (FIG. **4**B) having elements **417**, **419**, **421** and **423** with widths corresponding to the width **425** of a narrow display (e.g., a PDA display). The elements **417**, **419**, **421** and **423** are readable columns of information that each fit within the width **425** of the display window or can be reduced to a width that does not exceed the width of the display window **425**. The elements **417**, **419**, **421** and **423** are aligned to correspond with the topology of the page **400**. Thus, even though the page **415** exceeds the viewing boundaries of the display window, the user can view various portions of the page **415** with a better sense of the orientation of the content on the page **415** and can navigate on the page **415** more easily. Each column of text can be read without requiring the user to scroll back and forth horizontally. Instead, the user scrolls down as if reading a newspaper column.

Reformatting a page requires identification of the page topology from the page format coding. As shown in FIG. **4**, a common HTML page topology includes a header **430** with no logical columns, a body including one or more logical column elements **402**, **404**, **406** and **408**, and a colophon **435** with no logical columns. Other variations of this topology include a header, a first body having N columns, another header, a second body having M columns, with M being the same as or different from N, and a colophon; a header, multiple bodies, and a colophon; a header, a body, and no colophon; no header, a body, and no colophon; or a header, no body, and no colophon.

The topologies described above have some common features. For example, the headers usually do not contain long paragraphs of text. Thus, headers seldom need to be reformatted for the display window of the PDA viewing device. In the event that the header is wider than the display window, navigation through the header is not difficult for the user. Similarly, the colophon usually does not contain long paragraphs of text and may be easily navigated. Typically, the body or bodies are laid out in one or more columns. The columns can be constrained to the window width to enhance readability, as described with respect to FIGS. **3**, **4**A and **4**B. Based on these topologies, most HTML pages are readily reformatted into constrained sets of logical columns, with no column exceeding the display width.

Referring to FIG. **5**, a process **500** for enabling viewing of a page on a display includes detecting the page layout (step **505**), comparing the layout to the dimensions of the display window (step **510**), and reformatting the page into aligned

columns that are viewable on the display (step **515**). In one implementation, the page layout is detected (step **505**) by separating the layout of the page into components and then analyzing those components. The page coding may be identified to recognize formatting codes. For example, HTML code includes identifiable header, body, or table tags. Once the HTML tags are identified, the page may be recoded in a language other than HTML for easier viewing on the small display window.

The width of each logical column is less than or equal to the display window width. The logical columns may be produced by comparing the width of each column of the page to a width of the display window and establishing a new column width that does not exceed the display window width. Typically, the new column width is smaller than the original column width. However, in some implementations, a column that is narrower than the display window width may be widened to have a new width that does not exceed the display window width. The logical columns then are aligned for viewing on the display.

When the display is part of a client of a client/host architecture, the host may be notified of the display window size from information residing at the client or residing at the client. For example, the host may be notified upon establishment of a connection between the client and the host, at time intervals after establishing the connection between the client and the host, or after any change in the display window size. The host then may reformat the page based on the display window size prior to delivery to the client. Alternatively, the client may perform the reformatting.

Typically, PDA navigation is performed by using scroll bars to move on or between pages of information on the display.

Referring to FIG. **6**, another common PDA navigation feature is the capability to scroll the display window by placing a stylus **600** on the display window **605** and then dragging the stylus **600**. However, such "touch-and-drag" scrolling can result in information **610** that is positioned in the display window **605** but is difficult to view or read since the user may inadvertently navigate to a position where only a portion of a column or an image is visible in the PDA display window **605**.

Referring to FIG. **7**, to aid user navigation to view a desired text column, a display window **700** includes small icons **705**, **710**, and **715** that represent navigation buttons. Each of navigation buttons **705**, **710** and **715** represents a logical column of the page currently being viewed. The navigation buttons **705**, **710** and **715** provide the user with a graphical representation of the number of logical columns **700** available on the page. In other implementations, the navigation buttons correspond to columns of predetermined absolute or relative position within the page (e.g., leftmost column, rightmost column, left adjacent column, right adjacent column or center column). Each button also is used to properly position the display window **700** on the corresponding column of text when the user selects the icon. For example, referring to the tri-column display of FIG. **8**A, when the user selects the left-most navigation button **705**, the window **700** is positioned on the left-most or first logical column **805** of a page **800**. Referring to FIG. **8**B, when the user selects the central navigation button **710**, the window **700** is positioned on the second logical column **810** of the page **800**. Referring to FIG. **8**C, when the user selects the right-most navigation button **715**, the window **700** is positioned on the third or right logical column **815** of the page **800**.

The number of navigation buttons can vary according to the number of logical columns. For example, if a page displayed in the window **700** has just one column, then the display includes one column navigation icon. If the page being displayed has two columns, then the display includes two column navigation icons. Depending upon the display limitations of the window, any number of icons can be displayed to correspond with the number of columns. When the element displayed in the window is one that has no logical column, such as, for example, a header or a colophon, the icons for the following or preceding logical columns may be displayed depending on the user's preference.

As the number of logical columns increases, the user has more options for jumping discretely between columns. This can cause the user to become disoriented concerning the position of the page relative to the display window, which may result in the user selecting an incorrect scrolling direction to view other parts of the page. For example, referring to FIG. **9**, the user may begin viewing a page **900** by selecting a first column **905** of columns **905**, **910** and **915** for display in the window **920**. The user then may decide to jump to the third text column **915** to view the information in that column. Subsequently, the user may decide to return to the previously viewed first column **905**. However, since the appearance of the display window **920** changed instantaneously when the used jumped discretely between the text columns **905** and **915**, the user may not recall the position of the previously-viewed text column relative to the currently-displayed column.

Referring to FIG. **10**, as the user navigates to various positions on the page **900**, animation effects **925** are provided to give the user a better sense of direction and position. The animation effects add a sense of motion to the content being displayed. For example, in one implementation, when the user actuates a navigation button **930** to move to a new location on the page **900**, the user sees the page **900** slowly scrolling across the display window, as represented by the series of arrows **935** in FIG. **10**, until the new location is centered on the display window **920**. Animation also may be provided in response to a stylus or finger used on a display window with a touchscreen. The touchscreen may include, for example, a resistive sensor, a capacitive sensor, an acoustic wave sensor, or an infrared sensor.

Referring to FIG. **11**, a procedure **1100** for supporting navigation on a display includes providing a navigation control operable to change a viewable portion of a page of information on a display from a first view to a second view (step **1105**), permitting operation of the navigation control to change the display from the first view to the second view (step **1110**), and animating the display to create an appearance of motion as the viewable portion of the page of information changes from the first view to the second view (step **1115**). Operation of the navigation control may include operation of a device such as a mouse or trackball, use of a stylus, or use of a voice command.

Animation on the display may include one or more animation effect. For example, animating the display (step **1115**) may include slowly scrolling or shifting the display content to give the display an appearance of slow motion. In another implementation, animating the display (step **1115**) includes illustrating a visible portion of the page of information moving continuously on the display from the first view to the second view. In a further implementation, animating the display (step **1115**) includes drawing a line from the first view to the second view. In still a further implementation, animation (step **1115**) includes displaying a reference marker moving from the first view to the second view. This may be done, for example, using a separate window or portion of the display. In one implementation, the user selects a velocity at which to change the viewable portion of the page from the first view to

the second view. In another implementation, the user selects an acceleration at which to change the viewable portion of the page of information from the first view to the second view. The user also may select a constant or variable velocity or acceleration. For example, the user may select a variable velocity that begins scrolling the display slowly, picks up speed, and then slows down again as the displayed portion approaches the second view.

Referring to FIG. **12**, on a stylus-based PDA, the user can use a stylus **1200** to scroll a display window **1205** vertically down a page **1210** in order to read a column **1215**, **1220** or **1225** of text of the page **1205**. However, referring to FIG. **13**, vertical touch-and-drag scrolling has a drawback in that slight horizontal motion or "wobbling" of the pen **1200**, as represented by the series of arrows **1230**, can cause the text column **1125**, **1220**, or **1225** to become misaligned on the display **1205**, resulting in a misalignment between the column **1215**, **1220**, or **1225** and the display window **1205**. To correct for this and to view a desired one of the columns **1215**, **1220**, or **1225** in one view, the user manually centers the desired column in the display window **1205** by making one or more left or right corrections to the stylus **1200**.

Referring to FIG. **14**A, a vertical alignment control, as represented by the vertical bars **1400**, can minimize wobble of the display **1205** during vertical scrolling with the pen **1200**. As the user scrolls the page up or down with the stylus **1200**, the vertical alignment control ignores slight horizontal motion such that the text column **1220** remains aligned in the display window **1205**. This is based on the assumption that, when the window **1205** is positioned over a logical column **1220** and the user drags the pen up or down without significant horizontal motion, the intention of the user is to view only the logical column **1220**. Based on this assumption, the alignment control constrains screen scrolling to the vertical direction as long as the stylus stays between the bars **1400**.

The user can define the sensitivity of the vertical alignment control. For example, the user may specify a horizontal motion threshold (i.e., the spacing between the bars **1400**). If the threshold is not exceeded, any horizontal motion by the pen **1200** on the screen is ignored. If the threshold is exceeded, the displayed text moves left or right accordingly. In one implementation, the user can adjust the sensitivity of the horizontal motion by establishing a threshold for a parametric number of pixels. The two vertical bars **1400** represent the threshold of horizontal motion, measured as the parametric amount of pixels, which must be exceeded to scroll the display window **1205** left or right. The vertical alignment controls may be enabled or disabled by the user.

Referring to FIG. **14**B, in another implementation, the vertical alignment control is enabled when the user lifts the pen **1200** from the display **1205**. This causes the logical column **1220** to snap into alignment with the display window **1205** as the user stops scrolling. The user can adjust the snap sensitivity by, for example, setting the alignment control to snap to the nearest logical column based on a user-defined snap threshold. If the user's scrolling does not exceed the threshold, which indicates an intention to continue to view the text column **1220**, the display **1205** centers the logical column **1210** as the pen **1200** is lifted from the screen. If the user's scrolling exceeds the threshold, which indicates an intention to move beyond the boundary of the logical column **1220**, the display is snapped to the adjacent or repositioned column. In other implementations, no snapping occurs when the user's scrolling exceeds the threshold. The snap-on-column feature can also be animated to provide an appearance of movement as the display scrolls to the correct column-viewing position.

A similar horizontal alignment control also may be provided. Such a control may be used to limit vertical movement when scrolling horizontally in, for example, a spreadsheet application.

Referring to FIG. **15**, a procedure **1500** for supporting navigation on a display includes tracking user motion of an input tool for a display (step **1505**), comparing a motion of the input tool to a threshold (step **1510**), and constraining the position of the visible portion of the page of information on the display if the user motion does not exceed the threshold (step **1515**). The input tool may be a stylus **1200** or finger used on a display window **1205** with a touchscreen. The touchscreen may include, for example, a resistive sensor, a capacitive sensor, an acoustic wave sensor, or an infrared sensor.

The method **1500** may include separating the user motion of the input tool into a horizontal component and a vertical component. The horizontal component may be compared to the threshold to constrain horizontal motion of the page **1210** in the display window **1205** if the horizontal component does not exceed the threshold. Vertical motion may be left unconstrained, or may be compared to the same or a different threshold. In other implementations, only vertical motion may be constrained.

Referring to FIG. **16**, touch-and-drag scrolling of a display window **1600** may be limited to the width and length of the display window. For example, as the user scrolls from left to right across the entire width **1605** of the display **1600**, the document slides across the screen a distance that is equal to the width **1605** of the display **1600**. Thus, movement up, down, left, or right is limited to a distance that is equal to the length **1610** or width **1605** of the display **1600**. The user must then lift the pen or stylus from the screen and repeat the scrolling operation.

Typical desktop computers can associate movement of the operating system cursor with movement of the pointing device. In these systems, the cursor is both a software variable to detect user intentions and a graphic representation to provide the user with the location of the cursor. On a PDA, however, the cursor is not displayed on the screen because the tip of the pen already defines the location of the cursor. This location is forwarded to the application software by the operating system.

The operating system uses drivers that convert the movement or the position of the pointing device, which may be expressed in centimeters, to the movement of the cursor, which may be expressed in pixels. PDAs usually follow a paradigm inherited from the desktop computer, in that movement between the cursor is equivalent to movement of the document. Thus, the page scrolls an amount equal to the distance of the pen movement. For example, when the cursor moves 10 pixels, the document scrolls 10 pixels.

On a PDA or other device with a small display, scrolling the width or length of the display area provides viewing of only a small amount of document data. The user often must repeat the scrolling operation until the desired text comes into view.

A scrolling multiplier allows the user to specify movement of the document on the display as a multiplier or percentage of the physical movement of the stylus on the display. For example, referring to FIG. **17**A, when the proportional movement is set to 200%, document scrolling **1700** on a display **1705** is 20 pixels for each 10 pixels of stylus or other input movement **1710**. When the proportional movement is set to 50%, the document scrolling is 5 pixels for each 10 pixels of stylus or other input movement on the display. Referring to FIG. **17**B, when the proportional movement is set to 300%, the document scrolling **1715** is 30 pixels for each 10 pixels of stylus or other input movement **1720** on the display **1725**.

As shown in FIG. **17**A, when the proportional movement is set to 200% and a new display **1730** is centered around the endpoint **1735** of the maximum potential document scrolling, the user has the capability to scroll a document area that is nine times the area of the display window **1705**. Similarly, as shown in FIG. **17**B, when the proportional movement is set to 300% and a new display **1740** is centered around the endpoint **1745** of the maximum potential document scrolling, the user has the capability to scroll a document area that is 16 times the area of the display window **1725**. By contrast, when proportional movement is set to 100%, the user is able to scroll a document area that is four times the area of the display window. Thus, increasing proportional movement provides the user with the capability to scroll through several pages of the document with a single point-and-drag action. Alternatively, the user can make very fine position adjustments by setting a multiplier that is less than one.

An additional benefit is the enhancement in the perceived responsiveness and scroll speed capability of the application software. Since with the same action there is additional scrolling, the scrolling action appears to occur at a higher velocity. Stated more simply, the motion of the document is perceived to be zippy instead of sluggish. In another implementation, the user may set the multiplier based on the speed or acceleration of the pointing device. For example, a higher stylus velocity translates into a higher multiplier to generate the appropriate number of pixels to move the cursor. In yet another implementation, different multipliers may be used for horizontal and vertical movement.

For illustrative purposes, FIG. **18** describes a communications system for implementing a navigation aid to display information on an electronic device having limited display capability. For brevity, several elements in FIG. **18** are represented as monolithic entities. However, as would be understood by one skilled in the art, these elements each may include numerous interconnected computers and components designed to perform a set of specified operations and/or dedicated to a particular geographical region.

Referring to FIG. **18**, a communications system **1800** is capable of delivering and exchanging data between a client system **1805** and a host system **1810** through a communications link **1815**. The client system **1805** typically includes one or more client devices **1820** and/or client controllers **1825**, and the host system **1810** typically includes one or more host devices **1830** and/or host controllers **1835**. For example, the client system **1805** or the host system **1810** may include one or more general-purpose computers (e.g., personal computers), one or more special-purpose computers (e.g., devices specifically programmed to communicate with each other and/or the client system **1805** or the host system **1810**), or a combination of one or more general-purpose computers and one or more special-purpose computers. The client system **1805** and the host system **1810** may be arranged to operate within or in concert with one or more other systems, such as, for example, one or more LANs ("Local Area Networks") and/or one or more WANs ("Wide Area Networks").

The client device **1820** (or the host device **1830**) is generally capable of executing instructions under the command of a client controller **1825** (or a host controller **1835**) and is capable of processing instructions or queries from the host system **1810**. For example, the host system **1810** may query the client system **1805** as to the display size of the PDA device. The query may occur when the client **1805** and the host **1810** are connected or at periodic time intervals. The client device **1820** (or the host device **1830**) is connected to the client controller **1825** (or the host controller **1835**) by a wired or wireless data pathway **1840** or **1845** capable of delivering data.

Each of the client device **1820**, the client controller **1825**, the host device **1830**, and the host controller **1835** typically includes one or more hardware components and/or software components. An example of a client device **1820** or a host device **1830** is a general-purpose computer (e.g., a personal computer) capable of responding to and executing instructions in a defined manner. Other examples include a special-purpose computer, a workstation, a server, a device, a component, other physical or virtual equipment or some combination thereof capable of responding to and executing instructions. Often, the client device **1820** is implemented as a PDA or a mobile telephone.

An example of client controller **1825** or a host controller **1835** is a software application loaded on the client device **1820** or the host device **1830** for commanding and directing communications enabled by the client device **1820** or the host device **1830**. Other examples include a program, a piece of code, an instruction, a device, a computer, a computer system, or a combination thereof, for independently or collectively instructing the client device **1820** or the host device **1830** to interact and operate as described. The client controller **1825** and the host controller **1835** may be embodied permanently or temporarily in any type of machine, component, physical or virtual equipment, storage medium, or propagated signal capable of providing instructions to the client device **1820** or the host device **1830**.

The communications link **1815** typically includes a delivery network **1850** making a direct or indirect communication between the client system **1805** and the host system **1810**, irrespective of physical separation. Examples of a delivery network **1850** include the Internet, the World Wide Web, WANs, LANs, analog or digital wired and wireless telephone networks (e.g., PSTN, ISDN, and xDSL), radio, television, cable, satellite, and/or any other delivery mechanism for carrying data. The communications link **1850** may include communication pathways **1855**, **1860** that enable communications through the one or more delivery networks **1850** described above. Each of the communication pathways **1855**, **1860** may include, for example, a wired, wireless, cable or satellite communication pathway.

The described processes and techniques may be performed by a browser running on the client system **1805** (e.g., a PDA). The processes and techniques also may be performed at a host or other remote device (e.g., a server) through which a web page is passed or from which a web page is received. The processes and techniques may be applied both to large displays and to small displays, to display windows that occupy varying portions of a display, and to full screen displays.

A number of implementations have been described. Nevertheless, it will be understood that various modifications may be made. Accordingly, other implementations are within the scope of the following claims.

What is claimed is:

1. A computer-implemented method, comprising:

at a device with a touch screen display:

displaying a first portion of an electronic document;

detecting a movement of an object on or near the touch screen display;

in response to detecting the movement, translating the electronic document displayed on the touch screen display in a first direction to display a second portion of the electronic document, wherein the second portion is different from the first portion;

in response to an edge of the electronic document being reached while translating the electronic document in the first direction while the object is still detected on or near the touch screen display:

displaying an area beyond the edge of the electronic document, and

displaying a third portion of the electronic document, wherein the third portion is smaller than the first portion; and

in response to detecting that the object is no longer on or near the touch screen display, translating the electronic document in a second direction to display a fourth portion of the electronic document, wherein the fourth portion is different from the first portion.

2. The computer-implemented method of claim **1**, wherein the first portion of the electronic document, the second portion of the electronic document, the third portion of the electronic document, and the fourth portion of the electronic document are displayed at the same magnification.

3. The computer-implemented method of claim **1**, wherein the movement of the object is on the touch screen display.

4. The computer-implemented method of claim **1**, wherein the object is a finger.

5. The computer-implemented method of claim **1**, wherein the first direction is a vertical direction, a horizontal direction, or a diagonal direction.

6. The computer-implemented method of claim **1**, wherein the electronic document is a web page.

7. The computer-implemented method of claim **1**, wherein the electronic document is a word processing, spreadsheet, email or presentation document.

8. The computer-implemented method of claim **1**, wherein the electronic document includes a list of items.

9. The computer-implemented method of claim **1**, wherein the second direction is opposite the first direction.

10. The computer-implemented method of claim **1**, wherein translating in the first direction prior to reaching an edge of the electronic document has an associated speed of translation that corresponds to a speed of movement of the object.

11. The computer-implemented method of claim **1**, wherein the edge of the electronic document comprises an edge of a predefined portion of the electronic document.

12. The computer-implemented method of claim **11**, wherein the predefined portion comprises a column of the electronic document.

13. A device, comprising:

a touch screen display;

one or more processors;

memory; and

one or more programs, wherein the one or more programs are stored in the memory and configured to be executed by the one or more processors, the programs including:

instructions for displaying a first portion of an electronic document;

instructions for detecting a movement of an object on or near the touch screen display;

instructions for translating the electronic document displayed on the touch screen display in a first direction to display a second portion of the electronic document, wherein the second portion is different from the first portion, in response to detecting the movement;

instructions for displaying an area beyond an edge of the electronic document and displaying a third portion of the electronic document, wherein the third portion is smaller than the first portion, in response to the edge of the electronic document being reached while translating the electronic document in the first direction while the object is still detected on or near the touch screen display; and

instructions for translating the electronic document in a second to display a fourth portion of the electronic document, wherein the fourth portion is different from the first portion, in response to detecting that the object is no longer on or near the touch screen display.

14. The device of claim **13**, wherein the first portion of the electronic document, the second portion of the electronic document, the third portion of the electronic document, and the fourth portion of the electronic document are displayed at the same magnification.

15. The device of claim **13**, wherein the movement of the object is on the touch screen display.

16. The device of claim **13**, wherein the object is a finger.

17. The device of claim **13**, wherein the first direction is a vertical direction, a horizontal direction, or a diagonal direction.

18. The device of claim **13**, wherein the electronic document is a web page.

19. The device of claim **13**, wherein the electronic document is a word processing, spreadsheet, email or presentation document.

20. The device of claim **13**, wherein the electronic document includes a list of items.

21. The device of claim **13**, wherein the second direction is opposite the first direction.

22. The device of claim **13**, wherein translating in the first direction prior to reaching an edge of the electronic document has an associated speed of translation that corresponds to a speed of movement of the object.

23. The device of claim **13**, wherein the edge of the electronic document comprises an edge of a predefined portion of the electronic document.

24. The device of claim **23**, wherein the predefined portion comprises a column of the electronic document.

25. A non-transitory computer readable storage medium having stored therein instructions, which when executed by a device with a touch screen display, cause the device to:

display a first portion of an electronic document;

detect a movement of an object on or near the touch screen display;

translate the electronic document displayed on the touch screen display in a first direction to display a second portion of the electronic document, wherein the second portion is different from the first portion, in response to detecting the movement

display an area beyond an edge of the electronic document and display a third portion of the electronic document, wherein the third portion is smaller than the first portion, if the edge of the electronic document is reached while translating the electronic document in the first direction while the object is still detected on or near the touch screen display; and

translate the electronic document in a second direction to display a fourth portion of the electronic document, wherein the fourth portion is different from the first portion, in response to detecting that the object is no longer on or near the touch screen display.

26. The non-transitory computer readable storage medium of claim **25**, wherein the first portion of the electronic document, the second portion of the electronic document, the third portion of the electronic document, and the fourth portion of the electronic document are displayed at the same magnification.

27. The non-transitory computer readable storage medium of claim 25, wherein the movement of the object is on the touch screen display.

28. The non-transitory computer readable storage medium of claim 25, wherein the object is a finger.

29. The non-transitory computer readable storage medium of claim 25, wherein the first direction is a vertical direction, a horizontal direction, or a diagonal direction.

30. The non-transitory computer readable storage medium of claim 25, wherein the edge of the electronic document comprises an edge of a predefined portion of the electronic document.

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